VOLUME XXXVII APRIL, 1927 No. 2

THE MONIST

HEREDITARY AND ENVIRONMENTAL FACTORS IN HUMAN BEHAVIOR[1]

NEARLY twenty years ago, after the publication of McDougall's *Introduction to Social Psychology,* the psychological and sociological worlds were swept with enthusiasm for a new key with which to unlock the mysteries of human behavior. At last, we were told, we should be able to understand not only why people did things, but we should be able in a large measure at least to predict what they would do and to control the behavior. Some of the social and educational technologists seized upon this theory as a new mechanism which reduced man to a sort of machine, almost an electrical machine, which would work automatically. Once the proper stimuli were given, the responses would follow of themselves. The age-old mystery of what was man, the inscrutable, was now practically solved. After all he was but an automatism, inheriting his systems of levers and pulleys, stop-cocks and spigots, from that romantic past, the fund of racial traits. All that remained to make the instinctivist theory a perfect solution of the whole problem of human behavior, and hence of social adjustment, was to get the proper classification of the instincts. Once this was attained it would function like a keyboard, giving the manipulator—whether he be parent, educator, public administrator, propagandist, or legislator—the cue as to what in-

[1]Address delivered before the Iowa Association of Economists and Sociologists at Des Moines, May 1, 1925.

stinct to touch off in order to secure the proper response. To make the notation more accurate and dependable, elaborate systems of emotions and sentiments were also constructed to aid in the process of adapting response to stimulus.

Educationalists, sociologists, personnel men, social workers, humanitarians generally, began to invent their classifications of the instincts. No psychological or sociological writer was so poor as to be without a classification of his own, which was in many respects, he thought, better than the last previously to claim our attention. Some, like the Freudians, were content with one instinct, or at most, with two or three, and they quarreled over this slight extension of the number of instincts with the most ludicrous seriousness. Others insisted on a great many instincts, or original behavior patterns. You will remember that Thorndike filled a book with them. It all looked so easy then that textbooks, like the educational psychologies, and theoretical works for personnel men, like Ordway Tead's *Instincts in Industry,* were written incorporating this new revelation of the biological psychologists to the social scientists. It even went as far as economics and one of the fraternity, a very lovable personality with a leaning for Veblen and the psychoanalysts, brought in full measure his offering of (shall I say?) the new psychology to the new economics at a joint meeting of the American Economic Association and the American Sociological Society at Philadelphia, in December, 1917. As early as 1911 one of the distinguished sociologists, whom I shall not mention, because he has since repented, wrote me in righteous indignation protesting against my iconoclastic tendencies, asserting that sociologists needed nothing else so much as a firm scientific foundation for their subject, and that he had attempted to give it that in the application of the theory of instincts to the theory of social organization. He called upon me to desist from attacks which were, he conceived, like blows of an axe

at the very roots of the sociological tree and to be a cooperator, not an environmentalist bolshevik. This appeal is now interesting only as an illustration of certainties about what would be tomorrow. Its author has now joined the ranks of those who see the error of the old instinctivist view, which found the social science panacea in a classification of complex patterns of original behavior.

My own disillusionment had come a little earlier. The International Prison Congress was to meet at Washington in 1910 and Professor Henderson, its president, had asked me to work over the old classifications of criminals in the light of the new psychology and if possible to devise a correct one. I found it an extremely difficult task to perform from the biological standpoint and finally came to a conclusion not wholly unlike that earlier reached by lawyers and jurists, that a fairly good way to classify criminals is by their crimes. The multiplicity of classifications of instincts presented by different authorities confused me. How could such a self-evident theory as that of the instinctivist interpretation of human nature lead to so much contradiction about the character of the instincts? No two of these classifications agreed. And soon I found so many obvious errors in their theories of inheritance and so much disregard of the patent facts of environmental conditioning of responses that I decided to abandon the attempt and to try to find out, if possible, what the true instincts were and how they affected human behavior. I have searched long, and, I fear, largely in vain. If my results are mainly negative with regard to instinct, I trust that they are not wholly so with reference to environment. Not that I do not believe there are instincts, and that man has his share of them, although the requirements for adjustment to a highly complex and acculturated environment have caused some of his instincts to be disintegrated or rendered vestigial.

But the most important conclusion which I have reached

in connection with the theory of instinct is that almost all of the so-called instincts in these classifications are not instincts at all but are rather habit complexes or even abstract value and meaning complexes, sometimes of the greatest abstractness and complexity. The true instincts are largely of the simple character of reflexes, which, together with acquired elements of behavior, are organized into habit patterns, and are usually connected with the vegetative process instead of with the more abstract and intellectual adjustments of life. This organization of original behavior patterns into more complex habit systems and processes takes place under the pressures of environment, especially under those of the psycho-social environment. Lower animals are able to make their relatively constant and simple adjustments to their simple natural environments largely on the basis of instincts, or at least in the basis of simple and concrete overt habits. They live in a world of the non-intellectual or of the appetites and the senses. If they fail of effective adjustment, death is a matter of relatively little consequence in their social economy, for abundant reproduction will more than replace such losses.

But not so with man. His intellectual powers have created for him an environment of surpassing richness. His inventive processes have transformed the natural physical and biological environments into derivative physico-social and bio-social environments. He has fabricated tools, clothing, weapons, ornaments; constructed machines, apparatus for communication and transportation, and has built cities. All of these are his physico-social environment which stands between him and nature with which once he came directly in contact through his bare hands. He has also lured and domesticated and trained the biological environment of plants and animals, until this aspect of his natural environment has been transformed into a bio-social environment of much greater complexity and one that is

much easier for him to manipulate. But man's crowning achievement in the creation of environments is the psycho-social environment, the new world of meanings involved in language and other contact symbols, of psycho-social organization, such as traditions, customs, beliefs, conventions, mores, folkways, etc., and finally of objective social organizations as such, embraced primarily in the social institutions. These, like the other two more material social environments, are the product of man's reaction upon nature in his collective life adjustment process, and they have come, as they grew rapidly in volume, to stand largely between man and nature as the environments to which he has had to make his adjustments most immediately.

This multiplication of environments, ever increasing in volume and complexity, has reacted back upon human nature itself and forced the building of ever more intricate adjustment habits within the individual. The process is reciprocal. The social environments are either material objects created by habit variations, or they are themselves the acquired habits of men viewed collectively and funded as it were in the complex of culture, reacting back upon their possessors, but especially upon the new generations, to compel them to make ever new habit adjustments to the growing environment which they create. Thus the process is an endless chain. Habit variations from instinct create a new and social environment, of either a physical, biological, or a psycho-social type, and this new social environment calls ever for new adjustments. Whatever instincts man possesses are not capable of making these adjustments to so complex an environmental system. Even in infancy the instincts begin to be buried under a mass of acquired technique or habit behavior formation; and in many cases the instincts, considered as complex behavior patterns, as distinguished from reflexes, do not have an opportunity to appear. This is true of the delayed instincts. Even the

child's inheritance is somewhat selected in the direction of the elimination or breaking down of certain instincts by the domestic environment. The care of the family, especially of the mother, has relieved in large measure the infant of the necessity of taking care of itself. Consequently it has lost the power to find and procure its own food at birth, to walk or swim, to seek cover, and similar things which may be done by other animals. The environment makes for it the adjustments to the survival process which the inheritance has lost the power to do. And gradually the environmental pressures organize the native mechanisms of the infant into such behavior patterns as will enable it to make its adjustments to its environment. But these new and socialized adjustments are entirely too complex and abtract, in most cases, to have been made by the instinctive equipment, even if it had remained intact in the child. Hence the necessity of the replacement of instinct by habit or acquired behavior mechanisms, by means of this indirect and somewhat lengthened process of the disorganization of the inherited adjustment patterns on the one hand and of the building up of acquired adjustment patterns on the other hand, both occurring under the dominance or direction of the environmental complex. It is a necessity because of the new problems of adjustment to a rapidly changing and highly complex socialized environment which confront each new generation of men.

When I began to make a collection of instincts in order to determine if there was any agreement among writers regarding the true instincts, I discovered a most astonishing thing. I examined nearly six hundred volumes by over five hundred authors and discovered approximately six thousand separate classes of more or less complex instincts, as distinguished from reflexes, under nearly fifteen thousand different forms. And when I stopped, because of fatigue and the limitations of time and money, new addi-

tions to my collection were coming in strong. My experience in collecting instincts leads me to believe that to the inventiveness of writers in creating new instincts of a complex character there is practically no limit. I was almost tempted to believe that if one searched long and far enough for it he could find an instinct predicated for practically every type of human behavior known to man.

This view seemed to be borne out by the character of some of the samples of instincts which I found in my researches. Under the heading of peculiar instincts I have discovered such examples as these, in which the behavior is obviously acquired: "The drayman's instinct of chivalry" (Dawson), "Instinct of the desire to liberate the Christian subjects of the sultan" (Pares), "Christianity was born with the imperishable instinct to impregnate the meanest man with its soul" (Ross), "Instinct to mummify and photograph the corpse" (Jelliffe), "Instinct to offer himself as a sop to conventional honor" (Hergesheimer), "Instinct for engaging the grocery man in conversation while a companion makes off with the bananas" (Lee), "Instinct of the priest and soldier to exterminate their rivals" (Adams), "Instinct of an angry community to refuse cooperation" (Ross), "Instinct for stealing street signs, gates and barber's poles (Lee), "accountant's instinct to put aside realized income in favor of earnings" (Fisher), "Lamb had a fine instinct for apocalyptic passages" (Nation), "Instinct of the girl to arrange her hair" (Smith), "Instinct which distrusts the intrusion of the middle man in the supply of those services which require the highest and most delicate mental qualities" (Marshall), "Instinct to hide himself from the queen he had not died for" (Beerbohm), "An instinct in the Jew against Terefa, unclean food—i. e., unfit for consumption by the Chosen People, or prepared by non-Jews" (Fishberg), "Instinct of the Jew for corporate action in the booming of what he wants boomed and soft-pedal-

UMI

ling what he wants soft-pedalled" (Belloc), "Instinct in man to grow upward toward the light of his ideals, as a flower toward the sun" (Convict O. L. S), "The instinct of the savage . . . to ascribe an indwelling life to everything that moves, from the sun in heaven to the rustling leaves and the stones that roll from the hillside across his path" (Clodd), "Instinct for upholding the status quo" (Russell), "The first instinct of the capitalist is to retain counsel, not to advise him touching his duty under the law, but to devise a method by which he may elude it, or, if he cannot elude it, by which he may have it annulled as unconstitutional by the courts" (Adams), "Instinct of women, that they all worship strength in whatever form, and seem to know it to be the child of heaven" (Meredith), "The primal instinct of every female creature to battle for the male she feels is hers" (Minneapolis Journal).

A few examples of the use of the term instinctive when something else is meant may be cited: "Men act reasonably by instinct" (Bury), "A voluntary and conscious action can, under certain circumstances, become instinctive" (Chatterton-Hill), "Instinctive actions founded upon repeated and unrecorded experiences of an analogous kind" (Addams), "No nation acts more upon instinct than the British Nation" (Dawson), "The process of marketeering we may therefore interpret as the instinctive adaptation of individuals struggling for survival in a regime, ostensibly at peace, but nearer in reality to war" (G and B), "The method which he (the average citizen) instinctively adopts is to get up a petition of thousands of names and send it to the legislature" (Veiller), "Instinctive alliance of the Woman Suffrage movement with the uncertain and dangerous elements in our political life" (Johnson), "Amenities become instinctive when they are insisted upon in early life" (Small and Vincent), "The test of sanity which everyone instinctively applies is that of a certain tact or feeling of the

social situation" (Cooley), "Goldsmith . . . seems instinctively to have apprehended the conditions of change in Europe" (Pearson).

Such errors as these, where the writer is simply misusing the terms instinct and instinctive to cover an acquired behavior process because it was reflectively automatic, recurrent, unconscious, or possessed some other quality similar to the stability of instinctive behavior, are not so difficult to correct. To a person who understands the Mendelian theory of inheritance it is necessary merely to point out the example to convince him of the misuse of the term in these cases. In each instance the behavior is obviously acquired. It is the sort of mistake which would not surprise us greatly in literary writing, where we should not particularly expect the author to be familiar with the distinction between instinct and habit. But this sort of error seems to occur almost as frequently among many of the writers on historical, sociological, and economic topics as among the writers of fiction and travel. The only explanation of this fact which suggests itself to me is that as yet many of our students of the social sciences, at least of those who are now writing books and articles, have not had as careful a training in psychology and biology as they might have had.

But a more serious form of the misuse of the term instinct was found to be the constant confusion of habit and abstract meaning and value complexes with instincts. If one who has thought seriously about the problems will go over the various classifications of instincts as they are presented in the many books dealing with this subject, or as they are produced in part in my book on *Instinct,* he will find that most of the so-called instincts in those classifications are not instincts at all. They are habit complexes, or even abstract meaning and value complexes, which never could be reduced as a unit to overt behavior at any one time. Take, for example, such frequently recurring so-called in-

stincts as the maternal, play, fighting, workmanship, or gregariousness. Imitation and self-preservation would have been equally good examples, but no one seems any longer to have any faith in these old standbys of a generation ago. I have analyzed several of these elsewhere and anyone else can do it equally well. All of them have much the same failing when it comes to quality as real instincts. Let us take, on a venture, the so-called instinct of pugnacity or fighting instinct, because it is supposed to be such a universal trait in mankind, at least among occidentals.

Now an instinct is by common agreement something which is inherited. If there is a behavior pattern which is not inherited we call it a habit. The distinction between habit and instinct depends on the fact of inheritance and non-inheritance. Furthermore, what is inherited is always a material thing, not something immaterial or abstract and conceptual. All inherited things are concrete. They are unit characters and must be capable of being passed down through the chromosomes, or at least through definite structural elements of the cytoplasm, if we accept some other theory of inheritance than the Mendelian. I believe that no one would seriously contend for the direct inheritance of an idea or a value or an abstract quality. All inheritance is of structure, of biological structure. An instinct, therefore, consists of inherited neural behavior patterns, in which the end organs of the sensory system have an inherited susceptibility to certain types of stimuli which set in operation a series of connected neurons, whose synaptic connections as predetermined in heredity, and which lead over to a final muscular or glandular response, the mechanism of which is also predetermined in the inheritance. Instincts, therefore are primarily inherited neural and neuromuscular and neuro-glandular structures. Organs, as distinguished from instincts, are organized tissue structures, either neural or non-neural. Instincts usually predeter-

mine the adjustment of the organism as a whole, or at least a considerable portion of it, while the organ has a more limited function. Instincts are therefore usually more complex and more particularly concerned with adjustment behavior. On this understanding of instinct I believe all careful writers are agreed. It is difficult to see how an instinct, as well as an organ, could be anything less than structural. Biology knows no inheritance other than that of structure.

Let us apply these simple facts about inheritance of instinct to the particular so-called instinct which we have selected for examination. If fighting is an instinct there must be some neuro-muscular and neuro-glandular structure which is the basis of this behavior. What is it? In order for it to exist it must have some form and occur in space, that is, be a part of the human anatomy and physiology. That means, of course, that this structure must be a unit. What then would the unit neuro-muscular and neuro-glandular structure for fighting be? We discover immediately upon reflection that there are literally thousands and tens of thousands of behavior processes involved in fighting. The fact of fighting is not a simple concrete unit act. We may fight with our fists, with our feet, teeth, nails, with clubs, guns, cannon, torpedoes, airplanes, battleships, armies, industrial organizations, vocal tirades, newspapers, books, white books, yellow books, green books, and a multitude of other things. Think how differently we behave in each of the processes of fighting mentioned above. See how different are the neural organizations and the muscular responses. Surely to group all of these complex and simple activities under one instinct term, which implies a unit behavior process, is not justifiable. Yet that is exactly what the instinctivists have done in cases too numerous to recount here. An abstraction has been mistaken for a concrete unit of behavior.

Then, if there is no instinct of fighting, perhaps there

are *instincts* of fighting. Possibly we can break up this abstraction or value term fighting into concrete component elements which are actual instincts. Perhaps each form of fighting—with teeth, hands, feet, clubs, swords, guns, pens, etc.—is a unit process and is also inherited, as such, and therefore an instinct. If so, we should not speak of a general fighting instinct, but of an instinct for fighting with the teeth, another for fighting with a gun, and so on. Some of these activities we will find are not inherited at all, for the instruments, like guns, cannon, warships, fountain-pens, are of too late an origin to have as yet selected and generalized over any large portion of the human race the behavior responses involved. Biting, however, is an old response and the mechanism is apparently or conceivably inherited. Then, have we not an instinct for biting? This is conceivable but still an instinct for biting is not an instinct for fighting.

At this point we have revealed a situation to which I cannot give as much attention as I should like. Biting is an illustration of it. We can and do bite many things besides people. Most of us, after early childhood, deny ourselves whatever pleasure there may be in biting people and confine our activities along this line to the less pugnacious attack upon food. The farmer may bite his plug of tobacco, the housewife her thread, the embarrassed young man his tongue, etc. I mean simply that biting is an interchangeable unit in behavior. It has little meaning in and of itself; for everything depends upon what is bitten. Biting is a structural mechanism which, like swallowing, may be instinctive and it is provided to all human organisms. But so far as we know, it is not characteristic of this mechanism that it must be exercised on any particular object. To be sure, objects to be bitten will be rejected if the organism gains no benefit from biting them, while others will be bitten if the process proves valuable to the biter. Thus we

learn what to bite and what not to bite, and very early in our careers, as soon as we invent more effective methods of fighting, we learn not to bite other human beings at all. Therefore, I do not believe we can properly call the instinct to bite (if it is an instinct) a fighting instinct. The use of it in fighting, as elsewhere, is learned or adapted, not inherited.

The same principle of discrimination applies to other instinctive behavior processes which may be used interchangeably in fighting and in other complexes of behavior, such for instance as that of shrieking. It must be apparent, therefore, that the neuro-muscular responses afford no evidence of there being either a general instinct for fighting or specific fighting instincts apart from the employment of the same elementary and interchangeable instincts or reflexes in the service of other adjustment behavior complexes, like food getting, sewing, and the like.

If we examine the neuro-glandular responses involved in fighting, it may at first appear that we can make out a better case for an instinct of fighting on this basis than on the other. The stimulus which results in the fighting responses also calls forth a secretion of adrenalin which is thrown into the blood and results in a strong activation of the organism. Part of this activation is poorly coordinated, unless one's technique is especially good, and is therefore termed emotional behavior. The vascular system is worked over-time. Then is not this excess activation, sometimes called anger, which accompanies fighting the true core of the fighting instinct itself? Is not this the characteristic and unchangeable thing in the behavior process, as McDougall said? Many have thought so. But here also we find a difficulty. Practically the same sort of activation comes from numerous other stimuli and accompanies other types of response than fighting, such as fear, love, hate, strong patriotism, parental affection, loyalty to friends or a cause,

UMI

etc. The emotion is different in each case only on the recognitive side, which means that we recognize in ourselves, or at least experience, different attitudes toward the stimulus according to what we perceive or think the attitude or meaning of the object is for us. But the discharge and function of the adrenalin is the same in each case, except in amount or degree. And there is as much variation in this respect within anger as between anger and other emotions or so-called instincts. The final conclusion is that there is no way in which we can establish a distinct inherited general fighting mechanism or even several separate instinctive fighting mechanisms, distinct from other mechanisms of directly opposite signficance or meaning in collective behavior. All we can safely say is that there are certain instincts which the organism can use in fighting.

And what has been said here about fighting or the so-called instinct of pugnacity might equally well be said in slightly different terminology, and with reference to somewhat different mechanisms, of the so-called maternal instinct, acquisitiveness, self-assertion, self-abasement, gregariousness, and, in fact, of hundreds of other acquired value and meaning complexes which are miscalled instincts. These are not even unitary habits, for they never occur all together or at any one time or in any single place. They are abstract syntheses of behavior, which exist together only within consciousness. That is why when we call them value or meaning complexes instead of habits in the ordinary sense. They are in no sense properly termed instincts.

I do not want to make this analysis of the error of the instinctivists fatiguing, but I must mention one more idol of the forum to which they are inordinately attached. Many of them, even while they assert that psychology is a biological science, speak of "cores" and "tendencies" to act which are the heart of the instincts. In effect, they say that the overt responses or execution of the act may be acquir-

ed, but there is an inherited something within, which organizes these overt responses and which itself never changes. This is what McDougall termed the unchangeable central process of the primary and inherited emotion. Others call it a tendency; some an impulse. Others still seem to think of it as an immaterial mystical entity. This I suspect is the analogue of the old theories of spirits, which, like Socrates' Daimon ,watched over the behavior of their subjects and made them do what they desired. Really there is no such thing apart from the instinct itself. To see the fallacy of such a view we have only to remember that everything which is inherited biologically must be structural. What could this central core, impulse, tendency, or whatever it is, be except the neural structure of the instinct itself? It is true, of course, that every overt response has its corresponding internal neural organization. But these two together constitute the neuro-muscular mechanism of the instinct, or of the habit, as the case may be. If there is any directive factor within, we may be certain that it is not a mystical spirit entity, but this very inner neural mechanism of which we have spoken. And the arguments against the inheritance of complex instincts as a whole applies with especial force to the inheritance of this inner organization, for it is the heart of the behavior pattern.

Even more mystical and unverified is the object of faith of those who adopt a teleological view of instinct. They seem to hold that it does not matter what the responses are made of. They may be wholly acquired, but if the end or function of the behavior is determined by the nature of the organism the act is instinctive. I must confess that this reasoning is altogether too profound—or superficial—for me. It reduces itself to a complete absurdity in practice, for on this ground all behavior whatever should be instinctive, and I am convinced that at least some of it is not. I devoted several pages in a book I wrote on instinct refuting

UMI

just these arguments, and one psychologist promptly wrote me a long letter restating all the arguments in favor of the teleological view, as if I had not considered them, and said he did not know how they could be successfully met. Another psychologist reviewed my book and said I had proved the truth of the teleological view of instinct. It was all very bewildering. To me it seems the height of absurdity to suppose that we can inherit an end of an activity or that the inheritance of a mechanism can be stated in terms of the end or adjustment function of that mechanism. Inheritance can be described only in terms of the structure of the behavior pattern.

Then, if we are not creatures of instincts, what does dominate our behavior? If our behavior patterns are not inherited, whence does this organization arise? An older metaphysical answer might have been "From the will." But psychologists know that this will is only one of those anthropomorphic abstractions surviving from the metaphorical stage of mental and social sciences, used to indicate the direction which behavior takes as a result of the strongest motives and impulses. The will is no longer either spirit or divinity, but mechanism making adjustments. The factors, then, which determine any particular and immediate process of behavior are, on the one hand, the antecedent behavior patterns which have already been integrated in the personality as the result of impingement of environment upon the organic structure, inherited and acquired, and, on the other hand, the environment as it operates upon the organism at the time the behavior occurs. Thus environment, operating in the past to build up the accumulated behavior patterns and in the present to condition responses, is the most important factor in the control of human behavior. The cumulative effects of past environments upon the personality are usually more important in conditioning behavior than the effects of present environ-

ments. That is really what the metaphysicians meant by the hypothesis of free will. The personality does have more to do with the determination of conduct than present environments, but what the metaphysicians and the instinctivists failed to see is that the personality is itself determined primarily by environment pressures past and present. Nor does this fact deny the initial importance of inheritance. Man owes much to heredity. Most of the organization of his non-neural protoplasms and much even of his neural organization may possibly be traced back to inheritance, but the instinctivists should take note of the fact that the recent work of the experimental biologists, such as that of Child and Herrick, throws considerable doubt upon the inheritance of even these types of structures. Even if the foundations of his somatic organization and of his behavior are inherited, this inheritance does not equip him for modern collective life or even for individual survival. His instincts are too simple to direct his responses to the vastly complicated social environments, especially the pyschosocial, which have arisen out of the processes of his adjustment to what we call nature and to subsequently created environments. These socially organized environments have even begun to modify his inheritance, as we saw earlier, through their power of selection in the process of adaptation.

All of this seems patent enough when we stop to consider it. And yet seldom is its truth recognized. Human biology, most of psychology and the theory of education, and much of the social sciences, are now written from the standpoint of instinct domination. And yet these writings have not produced the evidence required to support their conclusions. It is all assumption, developed by analogy from the study of the lower organisms, especially the insects and kindred orders, and applied to collective and individual human behavior because of the great vogue which

UMI

biology attained among us in the latter part of the nineteenth century. There are fashions and fads in science as well as elsewhere. Perhaps those who feared the advancing influence of what they were pleased to call "materialism," also had a hand in this overemphasis of heredity. They would have nothing of "economic" or "materialistic determinism." Those were terms which in their minds were often confused with "infidelity." So, in order to escape from these demons they willingly became enslaved to a more ruthless one still, that of biological determinism. What could be more hopeless than to have all of your behavior predetermined by the content of the germ cells of the ape, the reptile, fish, and what not, back to the beginning of things living? And what irony for those anti-evolutionists who are also enthusiastic instinctivists, as I suspect most of them are.

As a consequence of these historical forces at work, the term environment has been until recently in considerable disrepute, especially among those with biological preconceptions. And yet under the term "nature" we have long since recognized the marvellous intricacy and preeminent power of environment. We have been awed and terrified by its tremendous influence in the form of cataclysms. Tornadoes, hurricanes, typhoons, floods, droughts, leave man weak and helpless. Epidemics and plagues he is beginning to control, though this control is as yet precarious and incomplete. In the realm of the social environments, the influence of invention, domesticated animals, cultivated plants, tradition, custom, and institutions, has been realized for centuries. But when the scientific term environment is substituted for the metaphysical term "nature," and when invention, domestication, customs, traditions, institutions, etc., are scheduled as environment, objections are likely still to be raised. From a scientific (and anthropocentric) point of view, all phenomena must fall under the categories of man

and the environments, although from a metaphysical and theological point of view, other factors may be admitted. In some of the past writings on the subject there have been intimations that environment is a vague, passive something, different from nature or social process. This loose and unstandardized usage of the word has led to a great deal of misunderstanding in social science. This vagueness and uncertainty attaching to the term environment must be removed by extended analysis and classification. The social scientists see this clearly and many people are now at work on the problem. Several studies emphasizing this point of view by men like Thomas, Reuter, McKenzie, among others, have already appeared, and others are on the way toward completion. If I am not mistaken, the next ten or fifteen years will witness a complete reorientation of the social and mental sciences and of their application to the problem of social adjustment, as a result of these studies in the social environments. I do not mean that inheritance will not always be recognized as an important factor in the organization and control, even of human behavior and social activities. But man's and nature's joint creations, the social environments as outlined so briefly above, are becoming ever more and more dominant over collective and individual behavior. Tomorrow, in the social sciences, belongs to the student of environment, just as the past fifty years belonged to the student of inheritance.

I have not time in this crowded paper to develop in detail what seems to me will be the result of this change of emphasis to environmental factors in the organization of individual and collective behavior. I have attempted to state the method and significance of environmental processes more fully elsewhere. But in a word I would say that it appears to me that this new emphasis in investigation will mark the rise of social psychology and the social

sciences generally to the status of true sciences alongside of psychology and biology. Economics, sociology, history and political science have already based their investigations primarily upon the assumption of environmental factors, which they have not adequately analyzed. Yet some of the best characterizations of the influence of environment upon the economic institutional organization of society have been made by such economists as Adam Smith, J. S. Mill, and Pigou. Seligman has attempted to classify the physical and biological environments of man. But few of the economists and sociologists have begun to see adequately the importance of custom, traditions, mores and institutions, although no other concept is of more importance to the new economics and the historian of culture. To the sociologist it is indispensable. Perhaps history and political science have suffered most from the gratuitous assumption of hereditary race traits and metaphysical trends and capacities unrelated to environmental conditions and causes. Recently economics in its worthy attempt to utilize the results of psychological investigations in its interpretation of the market and of production, has approached mainly through the wrong door and has entered the instinctivist blind alley; but it will soon find itself. Every science has always been primarily an attempt to analyze and organize some aspect of the environment of man.

The eighteenth century gave us the exact sciences of physics and chemistry, and the nineteenth century perfected their technique and made them usable tools for the creation of a new physico-social environment for man, through the invention of machinery and the creation of synthetic compounds and the extraction and transformation of the wealth of nature. The nineteenth century gave us biology and psychology as true sciences, and the early twentieth century is perfecting their techniques as usable tools for the service of man through a newly created bio-

social environment. The twentieth century is developing the technique of the environmentally based social psychology and social sciences and will add these to the agents serving mankind intelligently, for it will be the function of the one to create an effectively planned psycho-social environment and of the others to administer it and to determine the limits and character and functioning of all social or derivative environments on which man is dependent for his productive materials and personality development.

Perhaps some of you would feel that my paper would have been more in place at a meeting of psychologists, and others that after all it is an exercise in philosophic hair-splitting. So excellent an authority as Professor Knight Dunlap thinks it useless to attempt to distinguish between instinct and habit. But on the other hand, perhaps even more excellent authorities, Professors Dewey and C. J. Herrick, the neurologist, believe that such a distinction, made accurately and persisted in relentlessly, lies at the foundation of all constructive work in the social and educational sciences and practice. The social sciences must no longer be content with mere description. Description of the phenomena with which they deal is a valuable work to be done and must always have its devotees. But the social sciences have now arrived at the stage of development at which they must serve definite advisory functions in the construction of social policies. They must delve to the causes of things economic, political and social. They must learn to foresee the consequences of legislation and other forms of collective behavior. The problem of human nature—of whether it was predetermined for man in past geologic ages or whether it can be in large measure reconstructed in each new age, if we only know what environmental forces to put in operation—is at the very heart of the matter of the public service of the social sciences. I wonder if much of the quarrel which the anti-evolutionists

have with modern psychology and social science is not a dumb brooding and dimly understood fear on the part of these keepers of the public conscience that somehow the psychoanalysts, sociologists and other "new thought" ilk are trying to put over on their generation the morals and ideals (or the lack of both of these) of the dinosaurian ages under the banner of a new-fangled scientific terminology. If such is the case, we can relieve them of their fears at once.

Yet the environmentalist theory does not go to the opposite extreme of the instinctivist theory and hold that the social scientists may fashion any sort of world they please. Death will still menace us; the inhabitable portions of the earth cannot be expanded at will; micro-organisms will continue to be invisible, although the microscope and other extensions of our senses may locate them; human effort and human intelligence will always have limitations of some sort, and the glorious unlimited perfectibility of man, which was the dream of the eighteenth century philosophers, will never be more than a dream. Something can be done through breeding to make men better men—physically and mentally—but the chief avenue to social improvement, within the limitations of possibility, lies through the control of environment. To create new resources of intelligence and character is difficult, although not so difficult as the creation of new natural resources. But the better utilization of those human and social resources we have should be a much easier task when we learn better how to utilize the social sciences constructively.

L. L. Bernard

Cornell University

THE FIRST PRINCIPLE OF SOCIAL EVOLUTION

IT IS a commonplace that social changes often take place independently of human foresight or volition. Such changes, and the focusing of attention upon those that have happened to be progressive, are responsible in part for the social optimism revealed in such expressions as "God in history," "a power outside ourselves that makes for righteousness," "manifest destiny," and the like. Such optimism is derived from "counting the hits and disregarding the misses". To the fact of unwilled social changes may be ascribed also the social pessimism that regards man as powerless to control social events and determine social destiny, and the study of society with any hope of influencing social evolution as futile and visionary.

But the fact that "the world moves," sometimes in the right, sometimes in the wrong, direction should awaken curiosity as to what makes it move of itself, and the belief that a knowledge of how social changes take place might lead, as in other realms of phenomena, to the power to control them.

Now, a knowledge of *how* any movement takes place reveals a principle. Natural principles are the *modi operandi* of nature in producing change. When social changes occur that are unwilled by man, natural social principles are involved. A knowledge of these principles is the first step to the conscious control of social destiny. A knowledge of principles is power.

UMI

The principles of social change are many. Some of them have been discovered; many more will doubtless be revealed by further social investigation. Some are of limited application; they operate only in the natural movements of society; they are strictly social principles. Others operate throughout the entire realm of mental phenomena —they are psychological. Still others extend into every department of the biological world. A few are of universal application—they are cosmical. It is the purpose here to point out the most fundamental of these general principles, and to show how it operates, and how it may be utilized in the conscious control of social evolution. Treatment in so brief a space must necessarily be general. We shall begin with a glance at evolution in the inorganic world, since it is there in this simplest form of evolution that we may expect to find this principle most clearly displayed.

THE EVOLUTION OF THE ELEMENTS

The chemical elements are the different kinds of material particles, long supposed to be irreducible or indivisible, of which our material universe is composed. Some eighty of these elements have been discovered and named, —as oxygen, hydrogen, carbon, nitrogen, etc., etc. Theoretically, there are ninety-two. Our material universe is built up, that is to say, wholly constructed, of ninety-two different kinds of building blocks, and no more.

It has recently been ascertained that these so-called elements or atoms are not indivisible, that each one of them is a cluster of electrons revolving about a central hydrogen nucleus, or nuclei with other revolving electrons. This nucleus is called a proton. It is furthermore believed that electrons are identical in their makeup, and that all the elements are constituted of different numbers and arrangements of these identical units. There is, then, only one single primordial unit or element of which the universe is composed. Qualitative differences in the different chem-

ical elements are thus reduced to quantative differences, since they depend upon the number and orbits of the revolving electrons, and upon the number of hydrogen nuclei in the center of the atom. All chemical elements, then, are essentially the same. Here is a unity in diversity which has long been dreamed of, but which has only recently been discovered. It is literally true that all nature is one. But the fundamental unity of nature is not the only nor, from our present viewpoint, the most significant truth that emerges from the discovery of the nature of the atom. Atoms are merely combinations of electrons, and each atom manifests its own peculiar properties. Among these is that of uniting, under certain conditions and for reasons not thoroughly understood, into molecules. Each molecule, like each atom, manifests its own peculiar properties, and unites with others of its kind to form masses. The significant fact to observe is that each new combination manifests a wholly new set of properties. Given a practical infinity of single original and identical elements, new objects with new properties, that is, new creations, arise simply from new collocations of these original components. Each separate chemical element with its differential properties is simply a different system of electrons and protons; one system manifesting itself as oxygen, another as carbon, another as nitrogen, etc.; in one case a gas, in another a liquid and in still another a solid. All the chemical elements and hence all material substances, since they are composed of these elements, are merely combinations in different forms of the same primordial world stuff. So far as the inorganic world is concerned, given this world stuff, we know exactly how it is created. It is a process of combining similar units. Exactly the same things put together in different ways and proportions manifest themselves as the different elements. These so-called elements, and molecules as well, sometimes

enter into new combinations apparently without breaking up into their original units. There is thus compounding and recompounding. The law of recompounding or aggregation, says Ward, "consists simply in the assumption that in the formation of the more complex substances out of the more simple, the molecules of the lower orders enter bodily and as units into the constitution of those higher ones. That is, they are not, or at least not necessarily, first decomposed into their simpler elements and afterward combined to form the higher unit, but the units of the next lower order become the elements composing the molecules of the next higher."[1] The result of this process of recompounding is the formation of the various substances, and these substances manifest properties entirely different from those of their constituent elements. Thus, to take the most familiar example, hydrogen and oxygen, two gases, unite in the proportion of two atoms of hydrogen to one of oxygen into a new substance, water, with properties entirely unlike those of either of its constituent elements. Iron and sulphur combine to form iron sulphide which is just as unlike iron or sulphur as water is unlike the elements of which it is composed. Ammonia gas and hydrochloric acid unite to form ammonia chloride, commonly known as sal-ammoniac. Sodium and chlorine unite to form salt. It appears then, that in the whole inorganic world the only principle necessary to account for its infinite variety and its development is the principle of combination or compounding, and recompounding.

That this mode of accounting for the inorganic world is correct is confirmed by the well-known phenomena of isomerism, that is, of wholly different substances consisting of exactly the same elements united in the same proportions and with identical molecular weights. It is a well-known fact that there are many different substances which upon

[1] *Glimpses of the Cosmos*, vol. 5, p. 88.

the most careful chemical analysis reveal the same elements and none others. The chemical formula for sugar, for instance, is exactly the same as that for acetic acid. Carbon, hydrogen, oxygen, and nitrogen combined may produce a poison or a tonic, an explosive or a food, a medicine or an aroma. There is only one way to account for this curious fact. The differences manifested by these highly different substances may be explained only on the ground of a difference in the arrangement and the groupings of the constituent elements. The principle involved is the same in this case as in the others, namely, the principle of combination. Says Gibson, "we see some atoms giving up one or more detachable electrons which are accepted by other atoms, producing a disturbance in their electric balance, and causing the atoms to attract one another and become chemically united. In this way we account for the production of *all* the variety of compound substances known."[2] The principle of compounding, then, is fundamental in the natural changes or evolution that takes place in the inanimate world. We are now to see whether this principle may be traced upward through the phenomena of life, mind and society.

THE ORIGIN OF LIFE

Thus far we have considered only the inorganic world. Now, it was long thought that organic compounds could only be produced through the operation of a new principle, that is, the principle of life, the so-called "vital principle." But in 1828 Wohler, a German chemist, constructed in the laboratory for the first time an organic product (urea). It has exactly the same formula as ammonium cyanate. All that was necessary to change the inorganic into an organic substance was to dissolve it in water and add a little heat; nothing new was required. Since 1828 the number

[2] *Scientific Ideas of To-day*, p. 328.

of organic products artificially created has mounted to something like 150,000. They are easier to create than many of the inorganic compounds. And many of these compounds, both organic and inorganic, created in the laboratory are entirely new creations; they exist nowhere in nature. The chemist has actually become creator. Having discovered that the principle of creation in the chemical world is the principle of compounding, he is now able to create new substances through the utilization of this principle. Knowing the principle he is able to determine the product.

As yet the chemist has not succeeded in creating a compound manifesting all the properties of life. He may never be able to do so. But it seems reasonable to think that if the problem should ever be solved, it will be solved through the control of the same principle that operates in the realm of material things, that is, the principle of compounding. "According to the best knowledge of modern scientists, life (animate existence as differentiated from inanimate existence) began when for once all physical and chemical elements were present in the ideal proportion necessary for the creation of the first living cell." This is perhaps the general belief of scientists. The physical basis of life is protoplasm, and protoplasm is a substance the molecules of which are very complex. It is a mixture in large part of various *nucleo-proteids,* substances which in their molecular structure and chemical composition are the most complex bodies known. A molecule of protoplasm may contain thousands of atoms. Consequently, its chemical formula is difficult to determine. No wonder its properties are surprising. But when the formula is determined, if it ever is, when the chemist is able completely to analyze it, he will reproduce it, for it is the present claim of the chemist that he can constitute whatever he is able to analyze.

Be this as it may, we know that a molecule of protoplasm manifests a wholly new set of properties, and among these properties are motility, irritability or sensitivity, and metabolism, the primary qualities of living things. It is altogether reasonable, then, to suppose that the same principle theretofore at work in nature presided at the origin of life, and continues its operations into and through the field of living things; that the principle of compounding accounts substantially for the existence and evolution of organic and living substances just as it explains the appearances of the manifold substances of the inorganic world. Can we follow it further?

THE ORIGIN OF MIND

The next great step in the orderly process of evolution was the creation of mind. Mind, it is generally admitted, is primarily a function of the brain, and particularly of the gray matter, the cortex, a thin layer of highly organized matter enveloping the white matter of the cerebral hemispheres. It is complex almost beyond imagination, and this complexity is of the elements present in it, among which there is to be found absolutely nothing with which we are not already acquainted in the lower realms of matter. Mind, then, like life appears in conjunction with especially organized matter constituted wholly by the compounding, recompounding and organization of the original units out of which all material things are composed. That is to say, both mind and life are peculiar properties of matter especially compounded. In their creation and development, there apparently is nothing new save the new arrangements entering into the constitution of living matter including the gray matter of the brain. They are the products of combination and organization, that is, of compounding.

This is not to say that science will ever reach any final

explanation of life or mind. Indeed, it is not likely ever to reach an explanation of the properties of any combination of the original material elements. We know no more about why it is that, for instance, sodium and chlorine in combination produce the peculiar qualities of salt than we know why certain peculiar combinations of the elements produce organic phenomena, and in higher and more complex organization produce consciousness and mind. Science finds no final explanation of anything. At bottom all is miracle, or perhaps we should say unknowable, for the human mind is finite.

Mind, then, so far as we are able to see, is a manifestation of a peculiar and highly complex aggregation and organization of molecules, which in turn are combinations of atoms, which again in their turn are peculiar combinations of electrons. Mind is the result of a recompounding and organization of molecules which are themselves the products of the compounded electrons. Compounding, again, is the ultimate principle involved, at least the ultimate so far as our knowledge can penetrate.

THE BEGINNING OF SOCIAL GROUPS

Finally, in the orderly process of evolution from electrons to atoms, atoms to molecules, molecules to organisms, and to mind, we have combinations of organisms into groups. These groups appear, of course, among the lower animals as well as among human beings. Human groups were probably at first families, but, whatever they were, it is an admitted fact that early in human history nature had produced through the combination of individuals innumerable small heterogeneous groups. These groups are the social atoms. They came into contact, and there happened just what happened among the chemical elements, namely, new properties appeared, in this case new social properties. Gumplowicz assumes that the simplest and the original

social elements were primitive hordes. But whatever they were, there must have been a great number of them in remote antiquity. Now, "as soon as one group is exposed to the influence of another", he says, "the interplay of mutual forces ensues inevitably and the social process begins. When two distinct (*heterogen*) groups come together, the natural tendency of each is to exploit the other, to use the most general expression. This, indeed, is what gives the first impulse to social process."[3]

Is it not apparent that we have here a process exactly parallel to, or continuous with, what we have already seen to be true in the chemical, organic and psychic worlds? The social process, like all the lower evolutionary processes, is primarily a process of compounding. Only in the case of social evolution it is the compounding of social groups instead of chemical elements and molecules. Gumplowicz assumes that the natural tendency of each social group to exploit the other was the original generating factor in the social process, and this is probably true. There was not much intelligence in early times. Consequently men erroneously concluded that exploitation is the most effective method of the acquisition of property. Hence the first effect of the early contact of social groups was a display of hostility. To a student of primitive society it appears plain that war was originally the principal generator of the social process, and he is likely to conclude, as do Gumplowicz and many others, that it must always be necessary to that purpose. "War", said Heraclitus, "is the father of all things," and this is perpetually repeated. But it is not true. It is not war that is the father of all things, but compounding; in the case of society, the compounding of social groups. And this may be, and often is, effected by peaceful means. The mistake on the part of the glorifiers of war, and of those who claim it is a necessity though they profess to de-

[3] *The Outlines of Sociology*, p. 85.

plore it, is that they identify a mode of combination with the true cause of the social process. War appears to be the causal factor of social evolution merely because it was a conspicuous form of social contact in primitive times.

That it can be regarded as a factor now is the most serious reflection upon the intelligence of the race. "Give me the money that has been spent in war," said an early writer, "and I will purchase every foot of land upon the globe. I will clothe every man, woman and child in attire of which kings and queens would be proud. I will build a school house on every hillside, and in every valley over the whole earth; I will build an academy in every town and endow it; a college in every state, and fill it with able professors; I will crown every hill with a place of worship, consecrated to the promulgation of the Gospel of peace; I will support in every pulpit an able teacher of righteousness, so that on every Sabbath morning the chime on one hill should answer to the chime on another round the earth's wide circumference; and the voice of prayer, and the song of praise, should ascend like an universal holocaust to heaven." This is not mere rhetoric. War is the superlative and most conspicuous example of social waste, and to say that mankind cannot eliminate social waste is to deny the possibility of collective intelligence. War has been the father of some things, some good, some evil, but it is not the father of *all* things. It is merely a mode, and only one mode, of bringing about the combination and recompounding of social groups which in the long course of social evolution manifest themselves in an ascending order of families, clans, tribes, cities, states, nations; each manifesting new and peculiar properties exactly as do new combinations and organizations of chemical elements and molecules in the inorganic and the organic worlds. A true principle and the basic principle of social evolution, as indeed of all evolution, is the principle of compounding.

It is not surprising, then, that civilization first appeared in Mesopotamia, Egypt, Crete, and in the Central American funnel through which the various peoples of North America poured on their way to the south. A slight consideration of the geography of the old world and the new, and of probable early migrations, will show that the early civilizations arose in just those particular localities in which social groups were forced into contact by natural causes, and a favorable physical environment induced them to remain together and combine. The narrow and fertile valley of the Nile, for instance, was the retort into which heterogeneous social groups were forced by natural circumstances and more or less fortuitously fused into a higher social combination.

We have now seen that nature, apart from the conscious purpose of man, is in all realms truly creative; that the products of nature in the order of their appearance are electrons, chemical elements, inorganic substances, molecules, protoplasm, organisms, mind, society; that compounding is a universal principle. Nature creates; it also destroys. But in the long run it has manifested a continuous evolutionary process that has been called "creative synthesis," or synergy. What I wish to emphasize is that this natural process of synergy, plainly manifested in the world before man, continues in and through human society, and reveals to us the basic principle of social evolution,—the basic but not, of course, the only one.

SOCIAL EVOLUTION MAY BE CONSCIOUSLY PRODUCED

In all that I have thus far said there is nothing particularly new. That nature is creative is the thesis of Bergson in his *l'Evolution Créatrice*, and it is the fundamental idea of Lloyd Morgan's *Emergent Evolution*. It was earlier and much more clearly enunciated by Lester F. Ward. "I borrow this expression (creative synthesis)", says Ward,

UMI

"from Wundt, who gives the central idea of it in the following passage: 'There is absolutely no form which in the meaning and value of its content is not something more than the mere sum of its factors or than the mere resultant of its components.' But I shall make of it a still wider application than he does . . . . . it is a composite idea. The notion embodied in the second component is nothing more nor less than the fertile truth taught most clearly by chemistry that a compound of two substances is something more than the sum of those substances, and is in a proper sense a third and different substance. That its properties are in some way derived from and due to those of its components is not denied, but the relation is one that no human insight can fully comprehend. No one, for example, could predict in advance what kind of a substance would result from even so simple a combination as oxygen and hydrogen in the proportion of two atoms of the former to one of the latter. No one could have told till he had tried it whether the resulting substance would be a gas, like both the components, or a liquid, as it is at the ordinary temperatures, or a solid, as it is at lower temperatures. Much less could any one have told what its properties would be."[4]

What we have particularly in mind here, however, is not merely to point out that the fundamental principle of evolution, of all evolution and hence necessarily of social evolution, is the principle of compounding, but also to insist that this principle, utilized in chemistry, and in fact in all the lower realms of human effort, may also be employed or applied in the realm of human society, and the future development of society be to some extent thus directed. The knowledge of how nature brings about evolution, no

[4] *Pure Sociology*, pp. 78-80. The idea was clearly expounded long before this book or either of the others mentioned was published. See Ward's papers on *The Status of the Mind Problem*, originally published in 1893, *Glimpses of the Cosmos*, vol. 5, pp. 80-98, and "The Natural Storage of Energy," *The Monist*, Jan. 1895, pp. 247-263.

matter what kind, should enable man to bring it about himself if he has the power to control the elements which come into combination. This man can do and does in the subhuman realm. He may also increasingly determine the kind of social combinations that are formed in the future, and thus the kind of social properties that will be manifested in new social groups and new forms of culture. Man may thus be in a very real sense the architect of his own fortune, the determiner of his own destiny.

Now it is perfectly easy to see that if the compounding of social groups results in the manifestation of new social properties, that is, in social evolution, this essential condition of social progress may be secured in many ways, of which war is only one, and a most uneconomical one. Such combinations may be secured by federations, treaties, leagues, etc., as well as by war, and with much less expenditure of means and energy. Bring the social atoms and molecules together, and a social process begins. What the outcome will be we shall not predict. But change, that is to say, evolution (not necessarily progress) will result. The social units, like the chemical, will combine. For there is social as well as chemical affinity. We can produce social evolution. Let us now see whether we can control it.

THE DIRECTION OF SOCIAL EVOLUTION

In primitive times social combinations, and social evolution, could be achieved only by immediate contact and intermixture of the populations of social groups. Modes of contact through distant communication were practically non-existent, compounding necessarily involved physical and biological contiguity. Today, however, we have arrived at a stage in the development of the means of communication at which the combination or compounding of social groups may not necessarily be thought of as physical

interpenetration of populations. That is not the essential thing. The essential thing is the contact and combination of ideas and cultures. This may easily be secured in this age without the physical intermingling of one group with another. It may result, and does result, from the conquest and subjugation of one group by another. It may take place also peacefully and at a distance.

The heart of a civilization is the ideas it embodies. All that is necessary to effect a combination of cultures is to bring the ideas of the groups together. This is done today, more or less unconsciously, through the employment without a definite social purpose of the various means of communication, and evolution is taking place. But this evolution should be controlled. And how? By the determination of the ideas that are to enter into the new synthesis. This does not imply that we may or can select out the particular ideas that we wish to unite. What, then, should be the elements of the new compounding?

Well, we are generally agreed that the truth is always salutary. The ideas that should enter into new social combinations, then, should be true ideas. True ideas, we believe, are derived by careful, impartial investigation of the world in which we live, that is, by science. Bring together the true scientific ideas of the world and, though we may not be able to predict the exact result, we may safely rely on the outcome.

CONCLUSION

In organic and inorganic evolution, then, the basis of progress is the compounding, recompounding and organization of atoms and molecules; in social evolution, the units of combination are ideas.

Future society will depend upon the character and number of ideas that unite in future combinations. These are conceivably within human control. To say that man

cannot control future evolution is to declare that he has no control of the formation of ideas and their dissemination, and this, I suppose, no one would like to admit.

Two things, then, are fundamentally necessary in the successful control of social evolution. In the first place, the process of the formation of new ideas to enter into combination with other ideas must not be interfered with; and, in the second place, there must be free opportunity for these ideas to mingle and combine. The diffusion of knowledge by means of travel, formal instruction, exchange of books, magazines, etc., is by far the most economical means of bringing ideas together. War, I repeat, is wholly unnecessary. The most effective "broadsides" are those of ideas. The origination and diffusion of ideas, then, is the principle and necessary condition of social evolution.

But if social progress is to be achieved in any other than a haphazard manner, that is, in the manner of nature, through the compounding of ideas, it is obvious that the combination of truly progressive ideas is the consummation to be wished. Now, progressive ideas are determined by the careful investigation of the phenomena of nature. This is the sole source of truth. Those who declare that action or experience is also a source of truth merely mean that in action and experience ideas and truths are tested or interpreted.

It follows, then, plainly enough that there should be throughout the world a perfectly free flow of scientific ideas, and everywhere the most earnest and intelligent encouragement of scientific investigation. The greatest detriment to progress, the real "sin against the Holy Ghost", is opposition to science and to the diffusion of scientific ideas in human society, both horizontally and perpendicularly. Opposition to teaching the young the scientific ideas derived from the painstaking investigation of nature,

UMI

and to the early use of the mind in exercise upon these truths, is infidelity to the divine purpose of directing the evolution of society to higher and higher levels.

This means, of course, a universal education—an education which really involves the diffusion of scientific knowledge and the operation of the fundamental principle of social evolution, namely, the compounding, recompounding and organization of ideas, and the application of this principle in an intelligent effort to direct the future evolution of society. Other principles may and should be applied, but this one is fundamental.

"Let knowledge grow from more to more,
But more of reverence in us dwell,
That mind and soul according well
May make one music as before, but vaster."

I. W. HOWERTH
COLORADO STATE TEACHERS COLLEGE.

THE NOTION OF INTELLIGIBILITY IN SCIENTIFIC THOUGHT[1]

I

THERE has been a remarkable change of attitude in recent discussions on the meaning of scientific thought. Interest is no longer centered upon the rôle and nature of particular conceptions in isolation, nor even on the general character of conceptions as such. What is rather being attempted is inquiry into the broad structure of scientific thought as a whole, viewed in relation to the intellectual and emotional background in which it arises in the life of man.

It is probable that one underlying cause of this change is the orientation of modern physics in the direction of abstract and comprehensive theories. Such developments direct attention to groups of theories rather than to particular conceptions; and as they usually involve the sacrifice of some assumptions, or their reduction to dependence on others, they tend to throw into relief the relation between bodies of theory and their underlying assumptions. In short, philosophers of science, too, have been encouraged to generalize their results. The familiar critical accounts of the place of hypotheses in the scientific process are giving place to attempts at rendering more explicit the fundamental and often unconsciously held generalizations which lie behind our very "ideals of explanation" themselves, and mould the form of scientific theory.

[1] A paper read at the Sixth International Congress of Philosophy held in Cambridge, Mass., September, 1926.

UMI

Many modern writers illustrate this tendency; but I must content myself here with a bare reference to the work of Emile Myerson and A. N. Whitehead. The latter has stated, in his remarkable Lowell Lectures, the general standpoint of those who undertake such studies. He points out that when you are criticising the philosophy of an epoch (and the same is true of its science) you must not chiefly direct your attention to those intellectual positions which its exponents feel it necessary to defend. "There will", he says, "be some fundamental assumptions which adherents of all the variant systems within the epoch unconsciously presuppose. Such assumptions appear so obvious that people do not know what they are assuming because no other way of putting things has ever occurred to them."[2] The importance of this to the student of the philosophy of science has recently been stressed by Prof. Leonard J. Russell, who has traced in detail the influence of those wide preliminary generalizations which guide and condition investigation without being in any formal sense the natural outcome of the facts themselves. It has long been recognized that in narrower fields of scientific work, there is often, in Galileo's apt phrase, "a rape of reason upon the senses." But what Russell has specially in mind is the more pervasive and unobtrusive background of guiding ideas which are "so wide in their scope, so general in their nature, so tenaciously held in the face of contrary evidence, that they seem to express something in man's attitude to the facts rather than to express the mere facts themselves."[3] To those anticipatory but challenging generalizations he gives the names of "demands". Some of these demands are logical, as that for consistency; some aesthetic, such as the demand for simplicity. But the one with which we are concerned in this

[2]A. N. Whitehead, *Science and the Modern World*, 1926, p. 71.
[3]L. J. Russell, "Science and Philosophy", *Proceedings of the Aristotelian Society*, N. S., Vol. XXV, 1924-1925, p. 66.

paper is the demand that nature should be intelligible.

2

It is obvious that this demand for intelligibility is involved very early in the history of science: as soon, in fact, as we pass from the observation of particular events and attempt to group them into systematic order by means of hypotheses, however vaguely these may be expressed. "With the construction of theories science enters on a new plane in its development, and serves a different set of human values. Its facts, the product of local curiosities, now take an order, and serve the desire for comprehension. . . . The desire for knowledge becomes transferred into the desire for *significant* knowledge—significant primarily for contemplation and secondarily for practice."[4] This desire for compensation would clearly be doomed to frustration if the world were not intelligible. Scientific thought is therefore built on "the inexpugnable belief that every detailed occurrence can be correlated with its antecedents in a perfectly definite manner exemplifying general principles." These are the words of Prof. Whitehead who insists further that, but for this belief, the incredible labours of scientists would be without hope. "It is this instinctive conviction", he says, "vividly poised before the imagination, which is the motive power of research: that there is a secret, a secret which can be unveiled."[5] The final phrase is important. The notion of intelligibility implies not only that there is a secret, but also that it can ultimately be revealed. The idea of an "order of nature" must be very old: its origins are lost in the dim beginnings of man's rational awakening. But it has not always been further supposed that such an order can be attained by reasoned steps. Santayana has pointed out, for instance, that Goethe's *Faust* is based on the as-

[4] J. W. N. Sullivan, *Aspects of Science*, 1923, p. 11.
[5] A. N. Whitehead, *loc. cit.*, p. 17.

sumption that nature is fundamentally inscrutable. "She is not all open to eventual inspection; she is no mere mechanism of minute parts and statable laws. Our last view of her, like our first glimpse, must be interpreted; from the sum of her manifestations we must divine her soul. Therefore only a practical and rhetorical art, like magic, has any chance of unveiling her, and of bringing us face to face with the truth."[6] Hence Faust turned from the sciences to magic, just as others in our day turn to different arts as the prime revealers of nature's basic essence. Science, on this view, does not so much reveal the order of nature as bestow one upon her. Experience, to quote Santayana again, is turned into "so many reviewed events, the passage of so much substance through many forms." This phrasing has a familiar ring. It is reminiscent of Myerson's view that the development of science rests on a deep-rooted conviction of the human reason that a rational explanation of phenomena has been reached when apparent differences have been reduced to a real identity. Or again, we are reminded of Eddington's conclusion from the reduction of many of the laws of physical science to identification of substance: namely, that man filters out matter (and presumably other forms of substance) from the meaningless jumble of qualities "as the prism filters out the colours of the rainbows from the chaotic pulsations of white light."[7]

Two separate questions are clearly involved, then, in the scientist's belief in the intelligibility of nature. He assumes, first, that there is a consistent inter-relatedness of its parts; that there is, in fact, a structure: and, secondly, that science is competent to reveal that structure without distortion. It will be convenient to deal with those two aspects of our problem.

[6]G. Santayana, *Three Philosophical Poets*, 1922, p. 154.
[7]A. S. Eddington, *Space, Time and Gravitation*, 1920, p. 198.

3

The first aspect was stressed by Prof. T. P. Nunn in his book *The Aim and Achievements of Scientific Method*, published in 1907. For him, science is one of several possible alternative processes by means of which what he calls "primary facts" are rendered intelligible. And he explains that when he says a thing is intelligible he means that it "forms an element in a *system* of terms in relation."[8] What distinguishes the scientific process from other modes of rendering the objective intelligible is, according to him, the presence of no motive except the desire to render it intelligible. In short, the process is disinterested, or, in the words of Mr. Bertrand Russell, "ethically neutral." The assumption throughout is, however, that there is a structure which the process reveals. Broad puts this assumption in other words when he says that the proposition that the world is intelligible involves, amongst other things, the proposition that the world obeys the laws of logic.[9] He adds that this is all the pure mathematician requires, but that it is not sufficient for the natural scientist. Consideration of the further postulates involved in the notion of intelligibility as used in the natural sciences brings us at once to the second aspect of our problem.

We have stated this second "demand" implied in the notion of intelligibility as the belief that science is competent (a) to reveal the structure of nature, and (b) to do so without distortion. Now (a) is clearly a more fundamental requirement than (b): for the conditions necessary to attempts at discovery of the order of nature must be satisfied antecedently to any hope of successful discovery. Moreover, those preliminary conditions might exist without our being able to make use of them to reveal the truth without "distortion". In (b) is involved the whole ques-

[8] T. P. Nunn, *loc. cit.*, 1907, p. 47.

[9] C. D. Broad, *The Mind and its Place in Nature*, 1925, p. 507.

UMI

tion of the objectivity of science. I have elsewhere[10] put forward reasons for believing that the order of nature revealed in the sciences is objective, in spite of the all-pervading selectiveness of scientific work. I shall not, therefore, pursue this further here, but shall turn to the problems involved in (a): namely, what are the conditions without which all the attempts of natural scientists to discover the order of nature would be foredoomed to failure.

4

Broad has stated in his *Mind and its Place in Nature*,[11] three further necessary postulates. It would probably be possible to analyse out others; but I shall confine myself to the consideration of these three.

The first is that the laws of nature must be neither too numerous nor too complex. This postulate is clearly related to the aesthetic demand for simplicity. It is true that this seems at first sight to lead us perilously near to the kind of argument used for retaining the circular path of the planets: namely, that the circle is the perfect figure. Indeed, men of science have sometimes put the case in a form which is no less objectionable for being less obvious—as when Schuster remarked that "the strongest of our scientific instincts is our belief in the simplicity of nature." We must not assume simplicity; though we must recognize that, *if* natural laws were too complicated, their discovery would be impracticable. There is no inconsistency in accepting Fresnel's famous saying that there is no *a priori* reason to suppose that Nature takes any account of analytical difficulties; and, at the same time, making full use of such working principles as Mach's Principle of Economy and Occam's razor whose objective effectiveness depend on the truth of this first postulate. Explicit recognition of the need for this character of simplicity in natural laws, if

[10] A. E. Heath, "Objectivity in Science," *Proceedings of the Aristotelian Society*, N. S., Vol. XXVI, 1925-26, pp. 211-224.

[11] C. D. Broad, *loc. cit.*, p. 507.

such are to be discoverable, has an important consequence. It enables us to envisage the possibility that science may only emerge in certain restricted regions of space. Eddington has described the astounding chaos, the hurly-burly of fragmentary electrons and protons, in the high temperature interior of a star. He has insisted that these chaotic conditions must not be regarded as abnormal: on the contrary, it is the normal condition (in the statistical sense) of the greater part of the material universe. Our special conditions on this planet, which must seem like the still orderliness of death in relation to the normal chaos, may be the only ones where natural laws are simple enough for intelligible description.

The second postulate required by natural science is that it must be possible to isolate one phenomenon from all the rest, at least to one degree of approximation. The importance of this is that if this character of nature were absent, all forms of abstraction, and in consequence all forms of science, would be impossible. The part played, and played increasingly, in the sciences by abstraction has never been so fully understood as in our own day: and we owe the first advances in these studies since Greek thought to the genius of Prof. Whitehead. I can add nothing to his account. But here, as with the first postulate, explicit recognition throws light on the limits of science. For the final and characteristic result of scientific investigation based on abstraction is the production of equations. But there may be what Clerk Maxwell called "singular points" where the equations break down. Such singular points are where influences which are usually (to some degree of approximation) negligible assume a dominating importance. If there were many singular points our sciences would become chaotic. It does not follow that such disharmonies might not ultimately be resolved. Indeed, as Maxwell recognized, singular points are sometimes points of growth.

They may be the rough edges of the building, showing where the next construction is to be. Whether it is to be growth or failure, however, can only be empirically determined: but it needed the humble-mindedness of Maxwell to see in the optimistic 19th century, the theoretical importance of these signs of possible limits to scientific advance.

The third of the series of postulates is that our sensations must come to us in such an order as to reveal the laws really present. The possibility of other orders in our sensations has best been brought out, I think, in Mr. Norman Campbell's book, *Physics: The Elements,* where he makes it clear how great a part in the setting in fruitful order of our sensory observations is played by comparison with other observers. I shall not develop this postulate further, but refer only to one point: namely, that the need for this postulate discloses the possibility that just as there may be chaotic regions in space, so also there may be regions in time where science is impossible.

5

I will conclude this brief sketch of what is implied in the notion of intelligibility in scientific thought by referring back to what was said at the beginning about the tendency towards more generalized forms of scientific philosophising.

Modern science is taking more and more abstract forms. For full grasp of its vast operations one must stand away from the process and view it as a whole. Further, as addition is made to the superstructure of science, it is increasingly necessary to pay attention to the foundations on which it rests. That is why our philosophising on science must, within the limits of our powers, be made both wider and deeper.

A. E. HEATH
UNIVERSITY COLLEGE OF SWANSEA, WALES.

KANTIAN RELATIVITY

WHILE it is an oft repeated statement that Kant effected a "Copernican revolution", or thought that he had done so, there is a rather general confusion as to why he called it "Copernican". In fact, the criticism is sometimes made that, in its anthropocentricism, it is Ptolemaic rather than Copernican. Norman Kemp Smith[1] has shown that Kant's analogy is well chosen and accurate. Copernicus explained the apparently objective movements of the planets and the sun as projections, with reference to the frame of the fixed stars, of our own motion. The extension of this principle of explanation to a vastly wider field of knowledge constitutes Kant's "Copernican revolution", and amounts to a very general theory of relativity. The study of this relativity in the field of space, time, and motion is the object of the following discussion. The close relation which Kantian relativity bears to the Einstein theory and modern physics, though familiar to specialists, deserves a more widespread and general notice than it has hitherto received. At any rate, such a study may serve to place Kant in perspective, and to humanize what is often felt to be the most abstract part of his system.

In Newton and Leibniz Kant found conflicting teachers. Newton had distinguished absolute and relative space, absolute and relative time, absolute and relative motion.

[1] Smith, Norman Kemp, *A Commentary to Kant's Critique of Pure Reason*, p. 22-25.

UMI

Leibniz had made them all relative, for, according to his view, apart from objects existing or conceived, space and time do not exist. Newton associates this relational view with popular notions and prejudices. He says:

"I do not define time, space, place, and motion, as being well known to all. Only I must observe that the vulgar conceive these quantities under no other notions but from the relation they bear to sensible objects. And thence arise prejudices for the removal of which it will be convenient to distinguish them into absolute and relative, true and apparent, mathematical and common."

"I. Absolute, true, and mathematical time, of itself and from its own nature flows equably without regard to anything external, and by another name is called duration: relative, apparent and common time is some sensible and external . . . . . measure of duration by means of motion, which is commonly used instead of true time, such as an hour, a day, a month, a year.

"II. Absolute space, in its own nature, and without regard to anything external, remains always similar and immovable. Relative space is some movable dimension or measure of absolute space, which our senses determine by the position of bodies; and which is vulgarly taken for immovable space; such as the dimensions of subterranean, or aerial, or celestial space determined by its position in respect of the earth."[2]

Similarly Newton draws the distinction between absolute and relative position, and absolute and relative motion. Though he states these propositions dogmatically as facts they are probably no more than axioms which seemed to him self-evident, and which aided him in clear thinking. It is still possible, in spite of the most recent contributions to science, to adopt as one's foundation axioms the Newtonian space and time, and the Euclidean geometry. They may not

[2]Newton's *Principia*, Daniel Adee, 1846, pp. 77-78.

be the neatest or most simple axioms, and their self-evidence is no longer conceded, but they can hardly be successfully overthrown. The corollaries are that the world is infinite in extent, that it is infinitely complex at all stages, and that it has no limits in time.[3] In other words, it leaves us in a position of being unable fully to comprehend our world in its extent, complexity, or duration. It solves the antinomies of Kant by denying the thesis—that the world is finite—and asserting the antithesis—that the world is infinite.

Although for all practical purposes we may adopt the axioms of absolute space and time, there are difficulties involved which are more easily passed by than solved. Since all points of reference and all measurements are relative to human limitations and purposes, where shall be found the basis for the immovable space and the evenly flowing time? Newton felt the difficulty and took refuge in the theory of an all-pervading and immovable ether. This seemed so satisfactory that very little doubt was cast upon it, especially in view of the wave theory of light, till the negative results of the Michelson and Morley experiment of 1887 shook the confidence of the experimenters and the expectant world.

As for time, the conception of an absolute time, in relation to which all specific times stand, seemed to be demanded by the then recent discovery of Roemer[4] of the fact that light requires time for its propagation through space. To Newton this fact appeared conclusively to prove that there is a flow of time independent of any personal reference. It seemed to overthrow all theories which made time a matter of the succession of impressions or the mere strung-outness of experience or the relation of events of the world. The fact that all calculations had to be checked and

[3]Newton, however, thought it not inconceivable that God had created the world at a definite time.

[4]Roemer discovered that light requires time for its propagation and calculated its velocity in 1675; the *Principia* was published in 1686.

UMI

amended by taking account of the velocity of light seemed to give space and time an absoluteness that was inescapable.

Difficulties, however, were forced upon Newton's notice from the fact that no human observer can get a point of view that is in any sense absolute. Newton's reply was that absolute space and time are indeed beyond human perception and experience, but that they are God's *sensorium*. What for man is a vague conception and beyond his perception is for God a matter of clear perception. In the *Optics* he says:

"Do not these phenomena of nature make it clear, that there is a being incorporeal, living, omnipresent, who in infinite space as his sensorium sees, discerns and understands everything most intimately and with absolute perfection."[5]

This, of course, is the exact reverse of the position of Leibniz, his most illustrious contemporary and critic. Leibniz, beginning at the other end, and working from the nature of God to the necessary nature of the world, holds that space is in the world, not the world in space; that space and time are our confused way of reflecting the universe, whereas for God space and time do not exist; that space and time are merely the order of coexistence and succession respectively; that they are therefore entirely relative and are mere modes of our perception.

Kant, therefore, found in these two predecessors conflicting teachers. Newton was in the ascendancy and exerted the more direct influence, especially in the earlier works. Kant's earlier papers are nearly all on subjects connected with physics, mathematics, and astronomy, reflecting the Newtonian influence. His power of independent and constructive thinking, however, was soon manifested. In 1763 his paper on "The Conception of Negative Quanti-

[5]Quoted from H. Wildon Carr, *The Principle of Relativity*, p. 21.

ties" was written—a rather original contribution to the discussion showing among other things the relativity of the concepts of plus, minus, and zero. This paper is of some interest as indicating the working of his mind in the direction of a general relativity. The difficulty of reconciling Newtonian and Leibnizian space resolved itself by 1768 into what theoretically was its final solution. In a little paper[6] published that year he mentions a lost paper supposed to have been written by Leibniz on *analysis situs*. Since it was either lost or never written, Kant says, he will attempt to write what Leibniz included, or should have included in that paper. He then puts forward the theory of space which is included in the Dissertation of 1770 and included practically unchanged in the Aesthetic. His thesis in brief is that relative space, relative time, relative motion imply absolute space and time, not in the Newtonian sense, but as *ein Grundbegriff*, or fundamental conception, logically preceding all relations of coexistence and succession. He thus agrees with Leibniz that space and time are relative so far as they are given in experience in the forms of extension and succession; but he agrees with Newton in that the relative implies the absolute space, time, and position; and he differs from both in maintaining that they are not merely relations, nor yet immutable things, but are a priori *forms* of sensibility determined by the peculiar nature of human perception.

Stated thus baldly his solution seems formal. Kant's discussion in the Aesthetic has always seemed to me too abstract to give the reader anything like an insight into the significance of his problem or the value of his contribution to the discussion. The following account therefore centers on one of his latest works, "The Metaphysical Foundations of Natural Science" including "Phoronomy," the

[6] *Von dem ersten Grunde des Unterscheides der Gegenden in Raume, Werke* (Hartenstein), v. 2.

"Dynamics," the "Phenomenology," and the "Mechanics."

Motion

So far as motion is concerned Kant definitely and completely rejects the Newtonian conception of the absolute. "Motion of a thing," he says, "is the change of the external relations of the same to a given space."[7] And it is immaterial, he goes on to explain, whether you consider the body at rest and the space as moving, or the space at rest and the body as moving. There is nothing to show what belongs to the object, but only its relation to the observer. "For if the spectator place himself in the same space as resting, he terms the body moved; but if he place himself in another space enclosing this, in respect of which his body is resting, then the relative space is termed moved."[8] For example, in the popular illustration, if the billiard ball rolls toward the back of the table as the train gets up speed, to a person in the train it will appear to be in motion while his compartment is at rest, while to a person on the platform and looking through the window the ball will appear to be at rest while the compartment is moving forward and the table is slipping from under the ball.[9] The descriptions are equivalent.

Even if there were only two bodies in an otherwise empty space it would be impossible to conceive of their motions as absolute, "the motions of both being here not relative to the space surrounding them but only to that between them, which alone determines their external relation to each other and is thus only relative."[10] Again, in the popular illustration, a person in the train sees the station

[7] *Kant's Prolegomena and Metaphysical Foundations of Natural Science*, Bohn, Ed., 1883, p 152. All further references to this work will be to this same edition.

[8] *Ibid.*, p. 234.

[9] Illustration from Steinmetz, *Space and Relativity*.

[10] *The Metaphysical Foundations of Natural Science*, p. 152.

approaching, and a person on the platform sees the train approaching. Both are right since each carries his system of reference with him.

"The only possible absolute motion," Kant says, "would be that accruing to a body without relation to any other matter. But such would be the rectilinear motion of the *universe,* that is, the system of all matter."[11] Even this rectilinear motion of the universe as a whole could never be asserted as a fact or proved, but would have to remain as a mere possibility outside the realm of experience. In other words, absolute motion and absolute rest would be strictly equivalent.

Kant's position is simply that there is no frame of reference that is universally valid or that is in any way specially privileged, but that the system depends upon the position of the spectator, or the position which he imaginatively adopts. This amounts to the statement of the more subjective relativists that each one carries in himself his own frame of reference. Kant's illustrations are the stock ones used today in popular expositions of the theory of relativity to illustrate the same points.

Thus, if a boat is moving down a stream it is at rest in relation to other objects moving down the stream at the same rate. To an observer on the bank, however, the boat is in motion. Thus a point can be in rest and in motion at the same time. Similarly a point can move in opposite directions at the same time so that the sum of its movements is zero. For example, if a man walks from bow to stern of the boat at the same rate as the boat is moving down stream, with reference to the man on the bank he has remained at rest. If he walks at right angles to the direction of the movement of the boat, his motion, from the bank, is diagonal, being the mathematical resultant of the two motions. These and many similar examples illustrate

[11] *Ibid.*, p. 238.

the simple but fundamental principle that there is no system of coordinates that is universally valid. Movement and velocity are relative to the space-time coördinates with reference to which the measurement is made.

Newton had held that relative motions are all parts of a motion which is absolute to the ether, or the structure of space as a whole. He even attempted to give a demonstration of this. He asks us to imagine a pair of connected spheres, like a dumb-bell, hurled into space with a twirling motion so that it rotates about its common center of gravity. Even though there were no other body by which its inhabitants could observe its rotation, nevertheless both the fact that it rotated, and the direction of its rotation, could be discovered from the stresses of the connecting bar.

Kant quotes Newton and improves upon his example. He says that the rotation of the earth might be demonstrated even if there were no visible heavenly bodies by which to mark it. If it rotates, or if it moves in a circle, then it must be subject to some external force, and that force would have other effects which might be discovered. The rotation of the earth, he suggests, might possibly be demonstrated by sinking a deep shaft into the earth and dropping weights down. If a stone, instead of dropping perpendicularly, tended slightly toward the east, one might infer that the earth was rotating from west to east (because the stone was given a greater velocity at the surface of the earth than the earth has towards the center, and by inertia it tends to keep that velocity and go faster than the objects toward the center). I have never heard of Kant's experiment being tried. Foucault, however, some years later, demonstrated the earth's rotation by a simple experiment with a pendulum using the same principle of inertia which was at the bottom of Kant's suggestion.

But, asks Kant, what is the interpretation of these facts? Do they prove absolute motion? Not at all. While

circular motion *"seems* to be really absolute motion", these experiments would only prove it to be real rather than illusory. "It is nevertheless no absolute motion, but continuous change of the relations of matters to one another", and consists in "the conception of the reciprocally continuous retreat of each part of the earth (outside the axis) from every other part situated opposite to it in the diameter."[12]

Hence as far as experience goes and as far as reason demands there is no such thing as absolute motion. Kant sums up his conclusions thus: "Firstly, that all motion or rest is merely relative, and that neither can be absolute, i. e., that matter can be conceived merely in relation to matter, but not in relation to mere space without matter; in other words, that absolute motion, such, namely, as is conceived without any reference of one matter to another, is simply impossible."[13]

Space

Strangely enough, from the relativity of motion Kant deduces a sort of absolute space—not, of course, the immovable continuum of Newton in which all things are contained, but an intuition coming from the very nature of sense perception. We do not perceive space nor yet construct it, for it is the prerequisite of every perception and construct. Spatiality is one of the forms in which all objects are given. This would not necessarily prove that space is absolute, but only that it is an absolute fact that sense perception involves a spatial character. Why, then, does he adopt the absolute side?

What his argument in the *Phenomenology* amounts to is this: The law of inertia is fundamental to physical science, i. e., the conception of uniform motion in a straight

[12] *Ibid*, p. 239-241.
[13] *Ibid.*, p. 238.

line. Such a motion, however, is not a matter of experience since no one has ever observed true rectilinear motion; it is a mere possibility or idea, especially as applied to the system of the universe as a whole. Back of the conception of uniform motion in a straight line must lie the conception of a space which is unmoved in relation to the motion. Absolute space, then, is a conception still more fundamental than that of rectilinear motion. Even if you think of this space as moved you must conceive of a still wider space in relation to which it is moved. Hence back of all physical law, back of all experience, actual or conceived, lies absolute space, not as an object of experience but as a necessary idea. His conclusion therefore is:

"Absolute space is then necessary, not as a conception of a real object, but as a mere idea which is to serve as a rule for considering all motion therein as merely relative, and all motion and rest must be reduced to absolute space if the phenomenon of the same is to be transformed into a definite conception of experience."[14]

Kant's argument in this is not very convincing since the more obvious deduction would seem to be that motion and rest are relative terms, the one as fundamental as the other, and hence that the conception of an unmoved space in which relative motion takes place is unnecessary. This conclusion should have been the more obvious from his oft repeated assertion that it is immaterial whether you consider the body as moved and the space as resting or the body as resting and the space moved, or even both body and space as moving at the some time.[15] Indeed Kant was well aware that absolute space enjoyed a very tenuous existence in his system, and depended on the demand, impossible of satisfaction, for completion to infinity.

"Absolute space is in itself nothing and no object at all,

[14] *Ibid.*, p. 239.
[15] *Ibid.*, p. 233.

but signifies merely every other relative space that I can at any time conceive outside the given space, and that I can extend beyond the given space to infinity. . . ."[16]

This is an absolute space in a very different sense from that of Newton. It requires no immovable ether to justify it, and can be overthrown by no Michelson-Morley experiment. Nor is it God's sensorium, but only man's refuge from relativity.

That all particular spatial relations are relative is conceded by Kant. Indeed it is a direct corollary of his theory that space is an a priori form of sensibility. If space relations are functions of the organism or of mind, then they will be different for child and adult, for earth man, moon man, and Jupiter man, for flat-land folks and for fourth dimensional beings. Kant, in the earlier period, at least, was fond of speculating on the space relations on little Mars and big Jupiter, and of wondering whether disembodied spirits had space relations such as ours or perchance none at all. What things are in themselves, and whether space and time are attributes of them at all, we have no means of knowing. All we know is that for us things are presented in forms of space and time, and such forms are relative to human mind and sense.

Absolute space, then, finds little justification either from considerations of man or nature. The real source of Kant's views of space came, as we all know, from his high regard for the apparent certainty and stability of the achievements of mathematics. In the preface to the "Metaphysical Foundations of Natural Science" he exclaims:

"Newton in the preface to his mathematical principles of natural science . . . . . says: geometry is proud of being able to achieve so much while taking so little from extraneous sources. One might say of metaphysics, on the other hand: it stands astonished that with so much offered

[16] *Ibid.*, p. 151.

it by pure mathematics it can effect so little."[17]

His insight into the place of mathematics in the natural sciences is indicated by his saying that "in every natural science doctrine only so much science *proper* is to be met with as mathematics";[18] and again, "a pure doctrine of nature respecting *determinate* natural phenomena . . . . is only possible by means of mathematics."[18] He thought, for example, that chemistry could never become a proper science, "being incapable of the application of mathematics." Still less could empirical psychology become amenable to mathematical treatment. We have seen his prognostications largely disproved, not because he had a false impression of the function of mathematical constructs as the basis of any science, but because he could not forsee the developments of physical chemistry or statistical psychology.

Kant perceived that in order to understand nature we have to reconstruct nature and put it into forms of our own. Now pure numbers and geometry he thought to be the a priori forms which are peculiarly our own. They do not come from experience, he thought, but are pure constructs derived from the nature of our pure intuitions of space and time. To understand nature, then, we must assimilate it into our own being and reconstruct it in the molds of pure number and geometry.

This conclusion was based on what we should probably all agree to be a false assumption regarding the nature of pure mathematics. He assumed that their truths are absolutely certain, universal, and necessary, and apply without question to the objective world in which we live and move. We should probably agree with Hume that any a priori certainties in mathematics are analytical in the sense that they are derived directly or indirectly from the fundamental axioms, definitions, and postulates which form the

[17] *Ibid.*, p. 149.
[18] *Ibid.*, p. 140-141.

starting point of the particular branch of the science. We should also agree with Hume that to the extent to which these assumptions are derived from experience, or are thought to apply to the real world, they are subject to the same fortunes as any other empirical truths. For example, given that through a given point to a given straight line one and only one parallel can be drawn, it follows that the three angles of a triangle are equal to two right angles. But not long after Kant's death Riemann showed that there is nothing to prevent the assumption that through a point outside a given straight line two straight lines can be drawn which intersect at an infinite distance (i. e., two parallel lines), and that any number of lines can be drawn which do not intersect at all. In this case the three angles of a triangle would be less than two right angles.

Again, Lobatschewsky showed that one might assume that any two straight lines whatever in a plane intersect at a definite distance; that is, parallels do not exist. This is the axiom of spherical or elliptical space. In this case the three angles of a triangle would be more than two right angles. This elliptical space, combined with time as a fourth dimension, constitutes the Einstein four-dimensional non-Euclidean, spacetime which he believes to apply to this world of ours.

If it is true, then, that the synthetic truths of geometry have the same adventure of truth and error as the synthetic propositions of any other field of research, then it becomes unnecessary for Kant to demonstrate the possibility of a priori synthetic truths of mathematics. We read out of a triangle what we have previously read into it just because the science is at bottom analytical and hypothetical. Had Kant not been led astray by the apparently immutable character of mathematics (so soon to be overthrown), and developed the relativistic implications which he so suggestively commenced in "The Metaphysical Foundations of

Natural Science," an altogether different turn would have been given to philosophy.

As it was he got into the antinomies of the finite and the infinite and never successfully extricated himself. Einstein avoids the antinomy by the assertion that the world, at least for us, is definitely finite. A point travelling in a straight line returns to its starting point; a point indefinitely distant on the right coincides with a point indefinitely distant on the left. The world is, like the surface of a sphere in two-dimensional space, limitless or boundless, yet not infinite. The universe, both as regards extent and mass, has finite limits and can be measured. According to Einstein's calculations the whole universe has a diameter of approximately 100 million light years, or about 700 trillion miles. The exact figure, of course, does not matter to us. What is important to recognize is that it is possible to regard the universe as a closed continuum as far as distance measurements are concerned.[19]

Moskowski, who reports his conversations with Einstein on the above point, finds it impossible to avoid the question as to what lies beyond. In other words, he cannot escape Kant's antinomies.

" 'Nevertheless' said I (Moskowski) 'your universe pictures something inconceivably great: one might call it infinity expressed in figures. For in your world there still remains one property of infinity, namely that it imposes no limitations of motion of any kind. On the other hand, the figures proclaim a limited measure in the mathematical sense, however great this measure may be. This calls up the old restlessness of mind, due to the persistent question: What lies beyond? The absolute nothing? Or is it a something which yet does not occupy space? Descartes and many other great thinkers have never overcome this difficulty, and have always affirmed that a closed world is im-

[19]Moskowski, *Einstein the Searcher*, p. 123ff.

possible. How, then, is the average person to reconcile himself with the dimensions you have established?'

"Einstein gave an answer which, it seemed to me, offered a last escape to apprehensive minds. 'It is possible' so he said, 'that other universes exist independently of our own'."[20]

Whether or not this solution will strike the enquirer as satisfactory I do not know. Moskowski thinks that it forms a bridge between the thesis *finite* and the antithesis *infinite*.

Einstein himself, however, "clings with unerring logic to the strict mathematically defined conception of infinity, and allows no compromise with the non-infinite." That is, he adheres strictly to the conception of the universe as finite and measurable. As Newton adopted the antithesis *infinite*, Einstein adopts the thesis *finite*.

Time

It is a rather striking fact that while Kant devotes a large part of "The Metaphysical Foundations of Natural Science" to the analysis of space, motion, and matter, he gives no corresponding analysis of the *time* element of motion. This is probably due to a fundamentally different view which he held of the nature of space and time. Not till Bergson was time reinstated as an essential correlate of space and motion.

In the Aesthetic Kant adopts the position that time and space are widely different and distinct kinds of manifolds. The one he calls the form of outer sense, the other the form of inner sense. Space he treats from the mathematical and dynamical point of view, time from the psychological point of view. One gives us the outer world at an instant, the other the succession of impressions as represented in the stream of consciousness. It seems illogical that he should have adopted these two widely different bases of

[20] *Ibid.*, pp. 123-124.

analysis, and I am convinced that it led astray not only Kant but many who followed him. In the analogies, however, in the analysis of causality, he combines space and time in a way which is very suggestive.

To begin with, he tells us in the first Analogy that "change and succession are nothing but so many modes of time in which the permanent exists," and "without something permanent no relation of time is possible." Just as the relative in space implies an absolute space, so the relative in time implies the permanent. This does not prove an absolute time in the Newtonian sense of an even flow of change, but on the contrary it proves the reality of the permanent or *timeless*. As in the analysis of space, however, the obvious conclusion should have been that change and permanence are relative concepts, change having no meaning except in relation to the relatively moving. Bergson goes to the other extreme, making not permanence but change the most fundamental reality. Bergson's position is as rational as Kant's and no more so—each has seized on one of two relative concepts.

The inseparable conjunction of space and time, and hence the error of his widely different analysis of these two elements of motion, is brought out by Kant himself when he tries to distinguish extension and succession. Even the apprehension of space, he points out, necessarily involves a succession of impressions and hence time. To take in a building, for example, the eye must travel from foundation to roof line and from end to end, and rest on many points as it moves. Still more clearly is a succession of impressions necessary if the preception of extension comes from the sense of touch where the finger tips move all over the surface of the body. Hence even space is apprehended through a succession of impressions or by means of an inner manifold. There would seem, then, no sound reason for Kant's distinguishing time and space as inner and outer

sense. He might also have readily seen that lapse of time is only discernible by means of change in the outer world as perceived or imagined. Indeed, he points this out. How, he asks, can we distinguish the flux of impressions which give us space from the flux which gives us time? Simply, he answers, from the fact that you can reverse the space order but cannot reverse the time order. For example, a boat is seen on the river, is hid behind the hills, and is seen again further down. We get the same space whether we let the eye travel up-stream or down-stream or both in succession, but we cannot reverse the time situation in this way. It is plain from this illustration that the perception of time has involved space—up-stream and down-stream.

The space-time conception is still further strengthened when he introduces the concept of *event* with its ultra-modern ring, and shows that no object at all can be represented without succession.

"But as soon as I perceive or anticipate that there is in this succession a relation to an antecedent state from which the representation follows by rule, then something is represented as an *event* or as something that happens: that is to say, I know an object to which I assign a certain position in *time*, which, after a preceding state cannot be different from what it is."[21]

Now when we take an object and assign to it a definite position in time (with reference to a more or less arbitrarily chosen starting point or set of events) we have what in relativity is called four-dimensional spacetime with three co-ordinates in space and one in time.

Conclusions

In attempting to evaluate the contribution of Kant to the problems of space, time, and motion it is necessary to

[21] *Critique of Pure Reason*, tr. by Max Müller, p. 173.

keep in mind the tools at his disposal. The non-Euclidean geometries had not yet been developed, nor had the concepts of the electro-magnetic field. Kant, therefore, had essentially the same tools as had Newton and Leibniz. As compared with Newton he definitely abandons the view that we can ever demonstrate experimentally, or have any evidence from nature, that there are such things as absolute space, absolute time, or absolute motion. As far as experience is concerned he holds to the thorough-going relativity of space, time and motion. Moreover, the concept of absolute motion is itself unnecessary and impossible. But, quite illogically, it would seem, he thinks that the concept of relative motion involves the concepts of absolute space and time. The absolute is therefore retained in the case of space and time, not as possible objects of experience but as necessary concepts. This constitutes a definite advance over the position of Newton, forestalls the negative results of the Michelson-Morley experiment, and anticipates in some striking ways the relativity of Einstein.

Though led astray by the fact that he analyzed the concepts of space and time from such widely different points of view, he has in places related them in the concept of 'event' in a way almost worthy of an up-to-date mathematical philosopher. That is, as far as phenomena are concerned, he has not only a space relativity and a time relativity, but a spacetime relativity.

While recent relativity has developed from physical and mathematical calculations it is obvious that its main significance will not be confined to these fields. The extent to which it amends the simple formulae of Newton are too infinitesimal to make any serious difference to ordinary affairs or even theoretical computations. Even if the perihelion of the orbit of the planet Mercury does move forty-three seconds of arc in the course of a hundred years, in a hitherto unaccountable manner, or even if the star ray

is bent about one and seven-tenths seconds of arc as it passes the sun, these facts are of too minute magnitude seriously to upset the world. But the main significance of the results lies in the different view of the world that they suggest. It seems to me that what we get is an extension of the Kantian view of the world. Newton had held that entirely apart from human perception space broadens infinitely and time flows evenly and indefinitely. Infinite space and time are God's sensorium. Kant held, on the contrary, that space and time are functions of the organism. It is pure dogmatism, he held, to assume with Newton, that they are God's sensorium, or with Leibniz that for God they do not exist. What we do know is that for men and animals they are functions of the organism. They are objective in that all objects are presented in those forms, and in the sense that all human beings share the intuitions. Nevertheless, each man has his own point of view in analyzing an event. In much more thorough-going and precise form Einstein has taken the position that each moving system has its own spacetime co-ordinates and each man carries in himself his own system of reference. It is a long gap between Newton and Einstein but Kant is the significant connecting link.

E. T. MITCHELL.

UNIVERSITY OF TEXAS.

THE SYSTEM OF BRADLEY

THERE can, I think, be no doubt but that Bradley was a philosopher who rose high above his contemporaries in originality and independence of thought. The system of Bradley, like the systems of Spinoza or Berkeley or Hume, has gained few adherents, but who does not recognize in Bradley the strongest and most original thinker in English philosophy since the time of Mill? A study of Professor Muirhead's symposium *Contemporary British Philosophy* shows everywhere the influence of that subtle, critical dialectic, which was not only preparatory of Bosanquet's system, but which was negatively so important in the development of both Pragmatism and Realism.[1] A great source of Bradley's power consisted, presumably, in the fact that he made no appeal to authority, whether to the authority of philosophic tradition, science, religion or morality. He relied exclusively on the power of argument and freed himself from all dependence on others, even on Plato and Hegel. The unity and consistency of his system, combined with the fundamental clarity of his thought, are such as to make it a classical philosophical construction and it is safe to say that it will survive most of its contemporaries.[2] It will be studied, just as other classical systems of philosophy are studied, not as an embodiment of ab-

[1] In Muirhead's *Contemporary British Philosophy* (First Series) there are, by the Index, 28 references to Bradley, more than twice as many as to his closest rivals in modern English philosophy, namely, Russell and Whitehead, who have 11 references each.

[2] A German publisher announces the publication in the near future of a translation of *Appearance and Reality*.

solute truth, but as an argument, as a logical exercise, which although not in itself irrefragable, yet throws light on the problem of human life.

Of all cases of the superficial classification of systems, the description of Bradley as an Hegelian is probably the most misleading. Fundamentally, the system propounded in *Appearance and Reality* is a variety of Berkeleyan or psychological idealism and it possesses neither the strength nor the weakness of a purely logical idealism. The system of Hegel, on the other hand, as set forth by Hegel himself, was above all a type of rationalism, more specifically an example of dialectical rationalism. It moves primarily in a world of pure logical ideas, i. e., of pure logical categories. Pure thought, a self-evolving system of logical concepts, is for Hegel the core of reality. Now the fundamental tendency of Bradley is anti-intellectualistic. Far from representing the opposite pole to Bergson, as William James thought, Bradley represents simply another type of anti-intellectualism. His negative dialectic is a critique of the "abstract concepts of the understanding" and the outcome of his doctrine is that there is an inevitable inadequacy in our abstract concepts when applied to the concrete. The real is the concrete, the object of a possible sensuous or quasi-sensuous perception, and when measured by this standard our ideas are, as Bradley endeavors to show, always deficient. Now a logical idealism, such as is found in the systems of Plato and Hegel or Hermann Cohen, for example, always asserts that the idea is prior to reality or sensuous existence. Existence is measured by the standard of ideas and what does not conform to the demands of thought is forthwith declared to be unreal. But in Bradley's system the idea is measured by comparison to reality and is found wanting.

What was for Hegel a positive instrument for the dis-

covery of truth, the Dialectical Method, is used by Bradley in a merely negative way. The discovery of *aporiae* serves merely to degrade various seeming types of reality to the level of appearances. Unity and variety, relations, time and space, the self, nature as an object of knowledge, and the fundamental ethical and religious concepts are all dialectical in character. They contain contradictions, but these contradictions are always symptomatic of just one thing, namely, the merely apparent nature of the being under investigation. X is contradictory, therefore it is unreal. And what Bradley seeks is an undialectical realm, a being which shall be free from contradictions. The notion of an endless dialectic, of contradiction behind contradiction, is not to be found in his system. What he seeks is freedom from dialectic and this he finds only in the Absolute. Hence the Absolute is the end of all thought. It is an idea which cannot be further developed, since it is by definition free from contradiction. Now it is precisely at this point that Bradley ceases to be dialectical and becomes dogmatic. He assumes, without proof, that there must *be* such a thing as contradictionless reality. There must be an *end* to the process of thought; somewhere thought must come to *rest*. The subjective fatigue of the dialectician is transformed into an absolute end of thought. There must be a real which is perfectly self-contained and also completely consistent. This is the Absolute in which "somehow" all contradictions are resolved. And yet it really resolves none of the detailed contradictions which Bradley discovered, nor is it itself free from contradictions. Here is the chief difference between the Hegelian and the Bradleyan use of Dialectic. The method, as used by Hegel, was constructive and engendered a series of concepts of which each remedied the inconsistencies of the preceding concept. A system or series of concepts

arises, which might conceivably stretch out to infinity, although Hegel, of course, does not draw this conclusion. But in the case of Bradley Dialectic is used in a merely negative way and the non-dialectical Absolute is set forth in a bald, dogmatic fashion. The Absolute *has* such and such properties, Unity, Consistency, Consciousness, Perfection. The dialectic which had been used with such destructive power elsewhere is not applied to the Absolute. From this results what we may call the finitism and finalism of Bradley's metaphysics. The Absolute is proposed as a final solution of all problems which thought can do nothing but accept. There is evidently a possibility here, which it did not occur to Bradley to explore, the notion that reality is through and through dialectical, that thought can never hope to reach a final resting place, that it must pursue the Absolute through an endless series of appearances.[3] Such a doctrine would at least have promised an endless life to thought.

In the closing sentences of *Appearance and Reality* Bradley rejects the Hegelian identification of the real with the rational and proclaims in its place the principle of the spirituality of the real. "Reality is spiritual. . . . Outside of spirit there is not and there cannot be, any reality, and, the more that anything is spiritual, so much the more is it veritably real." This proposition admirably condenses the total import of Bradley's argument. The real is the spiritual. That is, the real is the psychological, the mental. The softening of the Hegelian panlogism into Berkeleyan spiritualism indicates precisely why it is improper to consider Bradley an Hegelian. There are for Bradley no categories save those of psychology which are applicable to the Absolute. The Absolute is described in terms of Thought, of Feeling, of Will, and, above all, in terms of Experience. Such concepts as those of mathe-

[3] *Cf.* Cohn's *Theorie der Dialektik*, Leipzig, 1923.

matical time and space, matter and force, or even of life and evolution in the biological sense give no clue for understanding reality. And the inner life is taken in no abstract way; Bradley is rather a keen and subtle psychologist perpetually bent on gaining the true psychic actuality and escaping all the "fictions" and "monsters" with which popular psychology is satisfied. In his discussion of the self, for example, he fairly outdoes Hume in his effort to discover the self in the concrete, in its introspective givenness. And it is in terms of what were for Bradley the actualities of introspection, that he seeks to interpret the real.

The introduction of psychological idealism takes place very openly and logically in the course of the deduction of the general nature of reality. Reality is consistent; that, says Bradley, we have assumed all along. Secondly, the real is one; this follows simply from the impossibility of absolute pluralism. Thirdly, the content of reality is sentient experience. It is this third theorem which constitutes Bradley's psychological idealism. "Sentient experience, in short, is reality, and what is not this is not real."[4] And in proof Bradley offers what has since been exposed —there is, I think, no dogmatism in using this word—as the fallacy of argument from the ego-centric predicament. "Find any piece of existence, take up anything that anyone could possibly call a fact, or could in any sense assert to have being, and then judge if it does not consist in sentient experience. Try to discover any sense in which you can still continue to speak of it, when all perception and feeling have been removed; or point out any fragment of its matter and aspect of its being, which is not derived from and is not still relative to this source. . . . Anything, in no sense felt or perceived, becomes to me quite unmeaning."[5] That Bradley should have thought that

[4] *Appearance and Reality*, p. 144.
[5] *Cf. ibid.*, p. 145.

there was here an *a priori* proposition, to be proved in so simple and direct a fashion, can only be explained by reference to the underlying and pervasive influence of Berkeley in his thought. Perhaps in the end some such proposition can be proved, but the attacks of the neo-realists have made it sufficiently plain, I think, that what is self-evident here is that what I perceive I perceive, while that the perceived entity cannot exist apart from the perceiver is a synthetic proposition which must be substantiated from some other source. No doubt the real, in one sense of the term, may be defined as that which is a *possible* object of sense-perception, but it hardly follows from this that the real is always everywhere an *actual* object of sense-perception.

The real then is experience, the one all-inclusive experience of the Absolute. From this it is no great leap to the assertion of the perfect happiness of the Absolute and to the discussion as to whether or not the Absolute enjoys a surplus of pleasure over pain. Bradley's bold question as to the amount of pleasure in the Absolute was due to his psychological empiricism and his desire to be concrete. A greater contrast between a logical idealism and that of Bradley could, however, hardly be found than in the question as to whether Reality experiences pleasure or not. Pleasure does not belong to the logical idea nor even to man as a rational being; pleasure and sense-experience belong to the animal man. And yet these seemingly lowly animal functions are made by Bradley into the very stuff of reality. For what is the Absolute but a gigantic piece of sensuous experience saturated with emotion? And how could a less rationalistic conception of the Absolute be formed?

The criterion of reality is the boasted principle of individuality and value. It is this principle which is to dis-

tinguish the "degrees of truth and reality" and thus establish the hierarchy of being. It consists of the two correlative principles of harmony and inclusiveness. The more inclusive an idea or a theory is, other things equal, the truer it is; the degree of truth varies with the range of facts covered by the idea. Again, other things being equal, the truer idea is characterized by a greater degree of internal harmony. The more real is, consequently, the *more inclusive* and the *more harmonious*. Bradley devotes a good deal of effort to proving that these two principles are really the same, and the connecting link is what the realists call the internal theory of relations. Grant that everything is essentially related to everything else, then that which is limited and partial will be the more contradictory. The two principles or criteria thus are resolved into one, which Bradley calls the principle of individuality. This principle, however, Bradley was unable to apply in detail in the sense of working out a definite scale of being. His actual treatment of appearance is always negative and is based primarily on the discovery of contradictions.

The abstract and formal theory of the internality of relations which Bradley takes for granted, without either naming or explicitly stating it, is really in the end paradoxical and self-contradictory. The theory asserts that nothing exists "apart from" anything else; hence until a man knows everything, all his knowledge is false. Since one does not know everything, one does not know anything. This theory is itself self-contradictory. It makes all partial knowledge impossible, and since the internal theory of relations itself claims to be knowledge, it too is false, since even its advocates do not know everything. Now this might be interpreted to mean that human thought is essentially dialectical and unable to free itself from contradictions. If this were true Bradley's own

system could not logically make the claims to absoluteness and finality which distinguish the concluding chapter, strangely entitled, "Ultimate Doubts."

No doubt the internal theory of relations has its good meaning. If we take it simply as denying the external theory of relations, as denying the ultimate discreteness and discontinuity of the real, it represents a strongly defensible position. The denial of absolute monism need not lead to an equally absolute pluralism of logical entities. The logical atomism of the neo-realists seems to be at least as artificial and unfounded as the Bradleyan monism. A similar remark would apply to Bradley's supposed proof of psychological idealism. The recognition of the fallacy of argument from the ego-centric predicament by no means commits one to any form of realism. That is to say, even though it is going much too far to hold that all reality is experience, the difficulties attaching to a theory of the external world as absolutely real and independent of all reference to consciousness remain. Certainly the dialectical difficulties connected with any form of realism are equal to those connected with subjective idealism.

Let us, however, return to the "principle of individuality" in its dual form, that is, in the form that the criterion of truth and reality consists of two things: *harmony* and *inclusiveness*. The connecting link, by which Bradley sought to prove that these two criteria are really the same, the internal theory of relations, may be omitted. These two properties together may be taken as defining a *principle of value* in general which has, at least, a considerable sphere of application. Thus, roughly speaking it is true that, in science, that hypothesis is the truer which explains more facts more harmoniously. That type of reality is more real which unites more appearances more

harmoniously. In the field of ethics, we may perhaps say with Plato that the good soul is harmonious as well as the good state, and the good in practical experience would consist in the greatest possible harmony of the richest possible experience. Harmony and inclusiveness may very plausibly be regarded as common features of the good wherever it is found, whether in cognition, in beauty, or in practical life. Plotinus says: "Health also exists when the body is organized as a unit, and beauty when the nature of the one holds the parts together, and virtue in the soul when she is made a unit and unified in a single harmony."[6] Unity and inclusiveness may well be taken as representing the two essential demands of the soul: the formal demand for unity or consistency and the material demand for richness of concrete experiential filling.

Two things are to be pointed out, however. In the first place, there is no need to assume that these ideal demands of the soul are actually embodied in anything. The criteria or norms of the soul remain valid as norms even though embodied in no actual existence. The existence of these norms, as embodied in the Absolute, by no means adds anything to their authority as norms. Let us rather recognize them as inherent standards or principles of consciousness as such, the true *a priori* in terms of which we judge and measure our experience. If we develop this idea we come to see that after all it is consciousness with its standards which is the measure of reality. Its ideals are prior to reality in that it only recognizes as real or as good or beautiful what conforms to them. It is not consciousness which must bow to absolute reality; it is rather reality which gains its being only to the extent that it conforms to the laws of thought. The principle of harmony and inclusiveness may well be the criterion of reality

[6] *Enneads*, VI, 9, 1. Trans. by Fuller.

by which we distinguish levels of being; it need not for that reason be regarded as having in addition a *de facto* existence in the Absolute.

A second thing to be noted is that it is dangerous to assume that the principle of harmony and inclusiveness necessarily leads to *one* Absolute in the three fields in which it can be applied, Logic, Ethics and Aesthetics. We need not assume that the maximum in each of these fields is identical with the maximum in the other two fields. That which wholly satisfies our cognitive powers, the absolutely real, need not thereby be the maximum of goodness or of beauty. To confuse the being which satisfies the intellect with that which satisfies the moral will, and this again with that which pleases the feelings, the Beautiful, is most questionable and is in fact the logical foundation of that tendency to mystical religion which is such a powerful motive in Bradley's system. To fail to keep Logic, Ethics and Aesthetics distinct and autonomous means that the maximum of goodness and beauty also possesses, even now, and apart from our effort, the maximum of reality and that the life of practical achievement and aesthetic creation is superfluous.

What is really strong and suggestive in Bradley is his negative dialectic. In the discovery and bold clear treatment of *aporiae* Bradley has no superior in the history of philosophy. It is when he seeks to set up a positive theory of reality that his weakness shows itself. He is obliged to propound his theorems baldly and to use his skill chiefly in showing that the facts of experience do not conflict with his propositions. His positive theory of reality is not only uninspiring; it portrays a universe which is essentially dead. There is this vast pool of "experience" which is sensuous and predominantly pleasant in character, in which thought and will are "somehow" absorbed. In

its static self-sufficiency the Absolute lacks the vital characteristics of even our human experience, namely, its transitiveness, its ceaseless forward movement. Human experience is a process in which the perpetual emergence of novelty is a striking feature. It is not so much in a state of static equilibrium as rather toppling forward. Incompleteness and the *process* of realization rather than the *state* of complete realization are what is characteristic of human experience at its best, and it is in these that the *life* of consciousness consists. The Absolute with its impossible completeness is in contrast a dead lump of psychic matter. The worst thing about it is that it is supposed to exist and to be in the end the only thing which exists. Were it an Idea in the Platonic or Kantian sense, a regulative conception, it would perhaps be tolerable, but as *fact,* as the *only fact,* it is quite as incompatible with the actualities of human experience as the grosser forms of naturalism.

In this connection the question may well be raised as to whether the psychologism of Bradley does not come to the same result as materialistic naturalism. The spontaneity and autonomy of consciousness are sacrificed to a reality in which our consciousness is absorbed and lost. Whether the pure activity of consciousness is entangled in the net-work of mechanical causation or is sunk in an ocean of "concrete experience" makes no great difference. The *pure fact* is in any case lost, whether in dead matter or in the equal deadness of the factual givenness of the Absolute. Hence there are important motives of historic idealism which are most inadequately worked out in Bradley. The doctrine of the spontaneity of consciousness is not clearly present. On the other hand, the principle of the priority of the ideal to the real, the doctrine that concrete existence points back to a world of pure thought, to an eter-

nal Logos, is also absent. On these points there is clearly a gulf between Bradley on the one side and Plato and Kant on the other. It is not the biological concretism of Aristotle, however, so much as the psychological concretism of Berkeley, which is, after all, the guiding thought. Now the gulf which separates psychologism from idealism is as wide and deep as any in philosophy. For the former the type of reality is the *psyche,* the being half of nature and half ideal. A more radical idealism, on the other hand, brings out more sharply the ideal principle in man, pure thought, pure spontaneity, and the possibility of apprehending an *ideal world* as the presupposition of the possibility of that actual world which is given to the senses.

WILLIAM CURTIS SWABEY.

NEW YORK UNIVERSITY.

THE AUTONOMY OF ESTHETICS

THE status of esthetics at the present time cannot be regarded with entire satisfaction. After more than a century of vigorous study its standing as a profitable object of thought, and still more as a real aid to the understanding of its subject matter, is still, on many sides, seriously questioned. Yet genuine interest in it continues to be felt; besides the more inclusive treatments of it we have numerous investigations into the psychological conditions of esthetic perception, many discussions of special problems, and a large amount of incidental comment by the critics and historians of the several arts. Not yet, however, has all this material been brought into a satisfactory fusion, or digested into a body of doctrine ample enough to be authoritative and solid enough to command general assent. It therefore seems appropriate to consider the causes of this condition, and some suggestions for remedying it.

The study of esthetics has, ever since its definite institution, been regarded as a branch of philosophy. The formal instruction in it offered by our colleges is given by the philosophical departments; the most elaborate treatments of its problems must be sought in the works of professional philosophers. This fact, obvious enough, indeed, is not an occasion for unchecked rejoicing. While thinkers of all persuasions have found in the esthetic field a peculiarly convenient or characteristic sample of experi-

ence at large, which they have used to illustrate all sorts of genera! positions, it is only too evident that such use of the esthetic has often been prompted by its convenience for the needs of a particular system, so that the data are no longer allowed entrance solely on their own merits, or freely and inclusively viewed. The average philosopher approaches them only after the main lines of his position have been fixed, and is accordingly inclined to see them from the angle which that position determines—an angle often limited enough, and at best likely to leave important considerations out of sight. At the same time, the scattered character of the contributions by less technical writers already referred to has made it harder to discern their real value, or to bring them to bear for the correction of the more strictly philosophical positions.

The condition thus created is, I believe, chiefly responsible for the present unsatisfactory status of esthetic study. Those who resort to it for the better understanding or the fuller enjoyment of esthetic experience as such are often puzzled by the discrepancies between what the philosophers tell them and what the observed facts seem to indicate; or, if they turn to work of the other type, they may find it hard to get at, and more suggestive than satisfying when found. With some, the result is the throwing over of esthetic speculation altogether; with others, a somewhat confused attempt to accept the evidence of both sides, in spite of apparent conflict; with still others, a more or less determined effort to revise their esthetic judgments in the light of the chosen position. Consequently, the differences of opinion which legitimately exist with reference to esthetic matters are sharpened by controversies only in part relevant to them and yet pursued with a vigor which only adds to the inherent difficulties of the subject. No doubt this condition may be exaggerated, no doubt there is more common ground than the disputants care to admit; but the empha-

sis is thrown on the disputed points, rather than on the implied or tacit agreements. When this is coupled with the prevailing tendency to reject any sort of standard or any principle of ordering, it is not strange that some observers should be left bewildered, and others contemptuous.

Those who feel that esthetics is a subject deserving of serious consideration, and who are anxious to do justice to all points of view, can hardly be satisfied with such a situation. They will be fain to ask whether this state of affairs must endure; whether we must either tie up our esthetic experiences to a particular mode of thought, at the risk of limiting or distorting them, or, on the other hand, abandon them to caprice, admitting frankly that they have no relation to a rational view of experience as a whole. I do not think that we are restricted to these alternatives, both undesirable; but the only real remedy must be the establishment of a definite counterview. No compromise, however well meaning, will suffice; we must offer a definite contribution, a firm and tenable position. In a word, we must proclaim and uphold the autonomy of esthetics; and the purpose of this paper is to show, in a general way, how this can be done.

If esthetics is to show its right to autonomy, it must prove that it possesses both a range of facts peculiar to itself, and a definite way of dealing with them. With regard to the first requirement, no serious difficulty appears. Most people seem to agree that objects exist which exhibit the quality called beauty, a quality not identical with truth, or goodness, or usefulness, or pleasantness, however closely it may be allied to any or all of these. We may not agree as to the reasons why certain things seem to us beautiful, or just what traits they usually exhibit; nor will there be exact agreement as to the frequency of beauty in the world about us, some being readier than others to recognize its

presence. But the existence of beauty in some measure will surely not be denied.

When, however, we turn to the second requirement, that of a definite way of dealing with esthetic facts, all hope of agreement may seem to have fled. Some persons assure us that our esthetic perceptions are so dependent on the accidents of our personality, so essentially variable and capricious, that the expenditure of serious thought on them is labor lost. Others, without going quite so far, yet maintain that the ordinary methods of clear thought are too clumsy to deal with such evanescent material, the essence of which evaporates when we try to analyze it. Both attitudes are inherited from the emphasis which for a century and more has been laid on the subjective side of the esthetic experience. We have been constantly assured that the real source of such experience is in its possessor; and since he who has it, or thinks he has it, finds cause for pride in the fact, merely personal preference is given undue weight. Such pride may plume itself on a refusal to appeal to any outward justification, or may support itself by a philosophy supposed to be inaccessible to the ordinary mind. In either case, the vicious circle is complete; interest in the beautiful ceases to be a normal human activity, and is thought of as either the possession of a very few choice souls or the annex of a particular philosophical system.

The obvious way of escape from this dilemma is to deny its necessity. There does exist a large body of thought on esthetic matters, partly the work of philosophers in the strict sense, partly the more casual observations of artists and critics. Even if the former is sometimes too rigid and the latter too cloudy, it seems rather bold to assert that all this effort has been to no purpose; it would seem both more modest and more profitable to assume that a comparison and a cross-checking of the two sides might lead to results which would command more general assent than can be

secured by either side in isolation. Unfortunately, however, there are serious obstacles to the immediate adoption of such a procedure, one of which is the exceeding complexity of the field. We find natural objects and combinations of objects which strike us as beautiful, perhaps to an extreme degree. We find other objects which have obviously been made by man to perpetuate a similar beauty; but we also find objects, equally man-made, which seem to have no counterpart in the natural world. There is thus a realm of natural beauty, as well as a realm of art, and the relation between them is by no means always easy to make out. Moreover, the realm of art is itself complex; there are several distinct arts, each with distinct forms of its own; even the products of a single art may differ widely, and the differences increase as we pass from one art to another. As we continue our inspection, we find that some objects—natural or artistic—yield their beauty readily, that others are less consenting, that some are reluctant or adverse, that some will not yield beauty at all. In short, as we go where beauty is most abundant, not limiting ourselves by any preconceived notion of what it ought to be, we find it distributed over a wide range, and appearing in a vast number of forms. It is equally absurd to think of it as something rare and specialized or as something too simple and easy to deserve much consideration. If some beauty can be drawn in "as simply as our breath," as Rossetti puts it, other beauty is remote and difficult of access; if some beauty is so obvious that we cannot miss it, other beauty is elaborate, or elusive, or highly organized. A strong sense of the complexity of the esthetic field is the only state of mind in which we can advantageously approach its problems.

Once this complexity of the field is realized, we can scarcely wonder that opinions about its parts should be equally diversified. The statement that "there's no dis-

puting about tastes" is usually the prelude to just such a dispute; indeed, we may well ask whether tastes are not really the things most worth disputing over. At all events, we do dispute about them; and if it is to be argued that that makes them capricious and unstable, we might logically go on to say that religion and politics should equally be discarded, because men are not of one mind about them. In other words, the very fact that men argue their esthetic opinions may be taken as evidence that such opinions are worth while. All we ask for them is a fair chance; let the unsound and the unbased by all means be discarded, but let us not, in alarm at any sign of conflict or fluctuation, hastily assume that agreement of any sort is impossible.

The state of mind in which we approach our task seems to me much more important than any immediate attempt to devise a method. If we are to reach any clear notion of why objects seem to us beautiful, of what traits beauty includes, we should surely seek the objects which display the quality most unmistakably, and see them, so far as we can, by and in their own light, without subjecting them to arbitrary requirements and rearrangements. We may then hope that such more general notions as we may frame will grow naturally from the facts themselves, instead of being framed in advance and then applied to or forced upon them. In this way we may hope to avoid the errors which have beset the periods that have conceived beauty in too narrow terms, and have consequently disregarded or denied those manifestations of it which would not fit into their formulas. Such an attitude, however, is not a prelude to a sudden plunge into "the great sea of beauty," with no definite notion of what we are aiming at or where we hope to come up. It is both possible and desirable to mark out certain great divisions, and to suggest what each will yield, before we proceed to a more methodical examination.

It seems fairly clear that the crucial esthetic problems

arise in the realm of the beauty of art rather than in that of the beauty of nature. Questions enough are raised by the relations between the two; but since the ostensible aim of art is to give us beauty in purer and more concentrated form, we can there study its traits more conveniently. But the field of art is itself sufficiently complex. Convinced though we may be that this complexity is based on a unity which justifies us in using the term "art" to include all its manifestations, we are forced to recognize the existence of separate arts, each with its own range of accomplishment, its own contact with experience, its own special problems; so that in each branch of art we find the same division as in art as a whole. Beside these objective differences, there are the parallel differences created by the varying sensitiveness of observers to the appeals of the several arts, a variation obviously in part responsible for the differences in concrete estimates, and for the difficulty of framing a comprehensive theory which will do justice to all the artistic facts. Putting the situation in a nutshell, we have, as the basic problem for such a theory, the reconciliation of an assumed but elusive unity with a manifest and often recalcitrant diversity.

The various attempts to meet this problem have in recent years tended to fall into two great classes, one the method of psychology, the other the method of history. It is natural enough to think that the best clues to the nature of the artistic process can be found by analyzing the mentality of the creator of the work, or of the recipient of it. Unfortunately, however, direct evidence as to the artist's state of mind is by no means easy to get. Many, perhaps most, artists, have not troubled to enlighten us on the point; and the words of those who have cannot always be taken at their face value, even when (as is not always the case) they are uttered by persons really significant as artists. The mentality of the recipient, on the other hand, is of

course more accessible to study; but even there what can be studied most conveniently are the general conditions favoring the acceptance of the simpler forms of esthetic value, rather than the more intense and personal reactions, which cannot be so readily commanded or examined. On the whole, I think, such psychological study has not thrown much light on the deeper problems which concern us, though it has undoubtedly helped us to a better understanding of certain underlying conditions.

If the psychological approach thus seems either too general or too inclusive, the historical approach may seem to promise greater certainty. Any well-preserved group of works in any art can be serially arranged, sometimes with a close approach to certainty, often with great probability; and such arrangement can often be conducted without reference to the identity of the artists, which may indeed not be known. It is undeniable that much aid has been rendered to the better understanding of esthetic values by the historical study of them; but this method, like the psychological, has its definite limitations. It is sometimes forgotten that we need a clear view not only of the surrounding and antecedent conditions but of the work itself; and this is especially true when, as often happens, historical study embarks on the pursuit of origins. The farther back we go, the less abundant does the evidence normally become, until we reach a point where it is largely replaced by reconstruction or conjecture. Again, the traits regarded as most important in the object to be explained may be those most apparent in or best suited to the historical method, not those which are esthetically most significant. In short, the danger is that of trying to explain the better known in terms of the less known, or looking outside for what is really in the object itself. There are gaps enough even in the history of the developed arts; and when we try to reconstruct the esthetic mentality of primitive man, we

have often an immense amount of speculation with a great dearth of solid evidence.

None the less, both modes of approach have contributed to the demarcation of the esthetic field. I believe that our assurance of the unity of art has its basis in the psychological, just as our sense of its diversity has its basis in the historical. The effort to find a common aim in the varied endeavors of artists, the more demonstrable similarity in the conditions under which esthetic values are reacted to, combine to suggest that art is essentially one, however great may be its superficial diversities. But the sense of these diversities is vastly increased when we look at the matter historically, and see how an art has flourished in a certain period or country and declined at another, how what is at one time treasured is at another scorned, how what is lost may by conscientious search and reconstruction be recovered. One point, however, must be insisted on: so long as our interest is primarily in the esthetic aspect, we must remember that both psychological analysis and historical study presuppose the existence of an already embodied esthetic value—in other words, of a work of art. The value of either method depends on its application to an object the esthetic importance of which is already clear to us on other grounds.

Unless this precaution is observed, the autonomy which we are defending is virtually surrendered; but if it is observed, we can point to two devices by which the task of theory may be prosecuted in the two departments. Our only safe point of departure is the esthetic experience as we know it when it is excited by an accessible work; only from that can we profitably study either its psychological or its historical conditions. But once this is settled, we can see that the esthetic situation, psychologically considered, is essentially triadic. On the one side is an experience in which its possessor has discovered an esthetic value;

on the other, an experience into which that value is to be transmitted; between the two, a device by which the transmission is to be effected—in simpler terms, an artist, a recipient, and a work of art. If we hold to this scheme in its simplest state, it enables us to do justice to its components without confusion, at the same time that they are held together in a definite relation. If we study it as actually modified in experience, we find clues to various problems which are much more troublesome if attacked without the help of such a device. It is not possible here to justify these assertions in detail, but it must at least be apparent that in this way psychological analysis of either artist's or recipient's mentality can be kept in close contact with the embodied esthetic value.

If, now, we consider a series of such triads, it is evident that we can draw connecting lines between each set of their constituents. There will be a series of artists, if their identities are known; a series of works, usually further connected by the employment of a similar artistic process; and a series of recipients, sometimes individuals, sometimes grouped into a more or less definite "public." In the first two series particularly we note the fact, already suggested, that the grouping usually proceeds by likeness, painters, sculptors, musicians, or paintings, statues, pieces of music, being taken together, and a definite art accordingly constituted. If we further examine such a series, we find that in some cases it clearly assumes the form of a cycle, rising from obscure or tentative beginnings to a climax of achievement, and sinking into decline or subsidence. This is so strikingly clear in the case of certain periods for which we have extensive information—notably Italian Renaissance painting and Elizabethan drama—that it seems natural to extend it to other periods of which we know less, and to interpret their scantier remains in terms of it. Whether or not it always works, it seems at least the most

promising instrument of order which historical research can employ.

It is also evident that in practice the two devices of triad and cycle offer each other mutual support and correction. Psychological conclusions, to be worth anything, must be drawn from a considerable range of facts, and this is pretty sure to mean a considerable period of time also, the content of which must, for clearness, be historically ordered. Conversely, after such an ordering, we must call in psychology to help us interpret the significance of the facts revealed. Why, for example, are works or periods which at one time are regarded as having little or no esthetic value later found or thought to have a great deal? Such shifts of taste are frequent, and some at least lead to permanent revision of estimates. The mere passage of time is not a sufficient explanation; there must be psychological factors at work. On the other hand, such a revision may be caused by the discovery of additional data, which open up new ranges of value, or show us some work in a completer setting. Neither psychology nor history by itself can do so much for esthetic theory as will be accomplished by a judicious combination of the two.

At this point we may conveniently pause to summarize the chief contentions which we have thus far sought to establish. We have shown that esthetics unquestionably possesses a subject matter of its own, if it can make good its claim to control it; and we have seen that the complexity of that matter justifies certain divisions of it for convenience of administration. The simplest such division is into beauty of nature and beauty of art. The latter, examined more closely, is found to possess a unity determined by psychological factors, and a diversity shown by the very existence of separate arts and reinforced by historical study of them. We also possess, in the devices of triad and cycle, definite means of dealing with these two aspects,

which can also be employed in combination. Hence it would seem that an autonomous esthetic, in definite control of its field, is not a dream, but a realizable activity.

It would, I think, be held by thinkers of practically every persuasion that esthetics deals with a certain class of values. This acknowledgement, however, does not oblige us to reach a definition of value in general before we examine the esthetic varieties of it. It is entirely consonant with the position here advocated that we should rather use esthetic value as a means of approach to value in general, thus avoiding some of the controversies which have arisen about the subject. Such a course, indeed, is only another aspect of that abstention from premature philosophical commitments which we have found desirable. If we wait until philosophers have reached complete agreement as to the nature of value, we shall wait a long while. It seems quite sufficient to assume that a value is some aspect of a presented situation which tends to satisfy some interest which we feel when regarding it, and that there is no sufficient reason why esthetic values should not coexist with other kinds. It is enough that they should be recognizable, not that they should be in every case pure. More than this we do not need; and so much seems in harmony both with the facts of the case and with the mode of investigation here set forth.

We do, however, need some convenient means of indicating the essential nature of esthetic value, as a guide to its ready detection. After examining a good many of the phrases that have at various times been proposed for this end, I have decided that the most satisfactory is Professor J. Arthur Thomson's description of the root of the esthetic experience as "a pleased awareness of specific arrangements." It has the advantage of fitting well into our triadic formula by emphasizing both the psychological factors and the presence of a definite object, thus rightly implying

that the total esthetic value belongs to the entire situation of which they form parts, not to any single aspect of it. It will then be the business of a developed esthetic theory to inquire what traits in the situation determine such a value, what are the psychological conditions of pleasurable awareness of this sort, and how, historically, such specific arrangements occur when and where they do. We have thus once more indicated the main divisions of such a study, and the means by which they are respectively to be approached.

This mode of approach seems to me to offer fair promise that varicus perils which have in the past beset the study of esthetics can be avoided. We shall not see one side of the matter so sharply that we can discern no other; we shall not think that a "line-case," hard to classify, makes all general notions futile. To fix our eyes exclusively on such cases is often to puzzle ourselves needlessly; to ignore them altogether in the interest of a supposed ideal is equally productive of misapprehensions. No rational person supposes that any scheme of division or classification will ever be quite adequate to the variety of individual experiences; but that is no reason why we should ignore such distinctions as we can clearly make out, or such groupings as naturally present themselves in the material. The notion of the unity of art must not be made to submerge the differences which the several arts as we have them actually present.

Moreover, the plea that esthetic speculation be at the outset divorced from philosophy of any specific type does not mean depriving ourselves of all rational guidance. We have still left two sources of such guidance: the more or less casual utterances of artists, and of critics who have closely identified themselves with the creative process, on the one hand; and the incidental discussions of esthetic matters by philosophically trained writers who yet keep close

to the facts, on the other. One reason why these sources of information have as yet been imperfectly utilized is the fact that they are widely scattered, often in detached remarks or in uncollected papers, so that many readers remain quite unaware of the amount of such material that actually exists. Merely to indicate the sort of thing that I have in mind, I may mention under the first head the detached but often illuminating thoughts of writers like Joubert and Grillparzer, the critical essays of Pater, the rich and little worked mine of literary theory in the prefaces and miscellaneous writings of Henry James, or, in France, the notable work of M. Albert Thibaudet and M. Paul Valéry. For the more strictly philosophical contributions, we have such things as the letters of R. L. Nettleship, the illuminating discussions of esthetic values and of the relations of art by Professor H. Heath Bawden, and the papers still in course of publication by Professor Helen H. Parkhurst.

The more we utilize material of the two sorts just described, the more shall we minimize controversy for its own sake, and the better shall we realize the existence of common ground. As the critics gradually work their way toward more inclusive views, and as the philosophically minded come closer to the actual esthetic facts, their joint endeavors will tend to meet, establishing points of contact and routes of communication which will produce mutual enlightenment. This does not mean that all difficulties will at once be met, all moot questions automatically answered; such a result, whether or not it be desirable, is assuredly not at present attainable. But much can be done to make clear the real points of difference, and to seek their solution in considerations really relevant to them, as determined by the traits of the esthetic field itself, and not in considerations remote, or even alien. It is just this sort of study that an autonomous esthetic is designed to advance.

The worst foes of such autonomy, as previous experience amply shows, are a desire for undue simplification and a disinclination to think things through. It is easy enough to lay down certain specifications for beauty on the basis of a limited range of esthetic facts, and to hold that whatever lies outside that range is either negligible or definitely unesthetic. When that temptation is reinforced, as it well may be, by insensitiveness to values outside the particular range, the result is bound to be a more or less ossified notion of beauty, such as may be seen in periods which it would be invidious to specify. Of the partial correction of such narrowness by historical study, with its revelation of fresh or neglected values, we have already spoken; but such study is not always enough, for the values thus brought into notice may be more curious than authentic. It is, however, generally true that a renewed sense of the extent of the esthetic realm is attended by a revival of historical study, and that such study is, as we have seen, one of the best correctives of partial or too narrow views.

Unfortunately, no such remedy for the second error is readily applicable. If a person is honestly convinced that esthetic values are either too slight or too elusive to bear careful thinking about, it is not easy to see how he can be brought to change his mind except by a shift of feeling on his own part. Refusal to make such a shift may take the form of flat disinclination to take the trouble, or of a more active pointing out of the confusion and uncertainty which do undoubtedly attend a good deal of esthetic speculation. I hope that what has here been said may incline some of my readers, if they entertain such a view, to look more favorably on the possibility of getting better results; and I do not conceal my own belief that esthetic matters are both as deserving and as susceptible of rational treatment as any others.

Success, however, cannot be hoped for without some

effort. Just as the philosopher finds it hard to do justice to all the aspects of his subject, so the student of esthetics finds it hard to do justice to all the aspects of his smaller field. Between the simplest esthetic perception of the immediately pleasurable and the most complex work of art lies a vast interval, which not everyone may span. Moreover, this interval is not uniform, but is divided into the provinces of the several arts; and since it is a well-known fact that the power to respond to their various sensuous appeals may be very differently present in a single person, it is not strange that very few can offer an adequately responding sensitiveness at every point. Even where there are no such complete barriers as color-blindness or tone-deafness, it is notorious that literary beauty may be keenly enjoyed where music has little charm, or that music may be a passion, and pictorial or plastic beauty a merely curious interest. Thus it requires a certain temerity to propose conditions that profess to apply to the esthetic realm as a whole, and also a certain caution in accepting the testimony of others as to the relative value of the different parts of that realm. The attempt to reconcile these rather conflicting standpoints is admittedly difficult; for too much caution is likely to seem captious, and too great assertiveness runs the danger of being called dogmatic.

It would seem, then, that just as the esthetic theorist may accuse the philosopher of talking about esthetic matters without direct acquaintance with them, so the theorist in his turn is exposed to the attacks of the admirer or of the artist who thinks his favorite art unfairly dealt with, and to those of the "plain man" who thinks all such discussion beside the point. Yet, so long as men are of opinion that art is worth thinking about at all, and so long as some of them cherish a conviction that the different arts have somehow or somewhere a common source or ground, so long will esthetic theory be attempted, claiming a kinship with

philosophy in virtue of its disinterested speculation, and with ordinary life in virtue of its desire to keep in touch with the actualities of artistic effort and achievement, and to make them better understood. The double task is not easy; if it were, it would be the less worth doing. Unless the risks are faced there can be no autonomous theory at all, but surely the trouble is worth taking.

In this plea for an autonomous esthetic theory, therefore, I am not proposing that we cut loose from methodical procedure, or discard any aids to sound thinking, but simply that we adopt a method which promises to avoid the difficulties that are bound to appear whenever esthetic facts are not approached directly. The essential question is, Are these facts important enough to warrant such a direct approach? I believe that they are; and I believe that I have indicated a rational division of the field that they occupy, and devices which can be effectively employed in the study of it. I believe that if we methodically apply these devices of triad and cycle to the psychological and historical aspects of the subject, and if we constantly take as our point of departure the clearest cases of esthetic value that we can discover, we shall reach adequate conceptions of a more general nature, and a better ground for the discussion of more subtle and disputed questions. It also follows that, in consequence of the combined unity and diversity of the field, we may hope on the one hand for a general esthetic theory, and on the other for a group of special theories, one for each art which proves important enough to deserve it. Neither task is simple; and results gained under the first head would always be subject to verification and extension in the light of those of the second. But if both tasks are conducted on the lines here suggested and with the auxiliaries previously mentioned, neither need despair of success.

What, finally, is to be said of the relations of such an

esthetic theory to philosophy in general? If I began by pointing out the disadvantages of their connection as it has heretofore existed, it was not with any intention of asserting that esthetics should forever hold itself aloof from all philosophical contacts. It is obvious enough that the ultimate problems of esthetics must necessarily bring us to philosophy; but I am convinced that the road to that conclusion here indicated is the absolute reverse of that which we began by noting. Suppose that, instead of making our esthetics a mere ornamental annex to our philosophy, we invert the process, and see what approach to philosophy would be furnished by an esthetic theory which should try, as directly and thoroughly as possible, to consider all the relevant facts and their implications before going on to consider what part they have in the wider scheme of things. I suspect that such a theory might profit the plain man by leading him to deeper views of positions with which he is already familiar in their simpler forms, and might equally profit the philosopher by showing him how his categories might be filled in with a more concrete content. In this way it might escape the disadvantages of too exclusive domination by a particular philosophy, might unify the scattered contributions by a more thorough working out of their implicit conceptions, might reveal the common ground that underlies current disputes, and might, in short, demonstrate that thinking about beauty is both a normal and a profitable activity. For my own part, I believe that this is a goal well worth striving for.

CHARLES E. WHITMORE.

UNIVERSITY OF MICHIGAN.

THE NATURE OF COHERENCE IN AESTHETICS

ANY one moment of human experience is not orderly, but chaotic. If the objects which form that experience could be perceived simultaneously and completely, they would not appear harmonious and orderly, but discordant and unrelated. Thus, what has the noise of a motor car outside to do with the scratching of my pen, or the shining arc-light with the creaking of the veranda chair? Although unrelated by nature and systematically irreconcilable, all these experiences must be dealt with by the organism. A meaning is sought for each object, because toward each man must take an attitude, and because everything that registers on consciousness, however weakly, must somehow be dealt with and disposed of. Yet, how is man, with very limited powers of attention, comprehension, and physique, to deal with the infinitude of events that are occurring simultaneously and within the range of his perception every moment of his life? Some response is demanded, even if it is no more than the unconscious decision to ignore what seems irrelevant. To meet such a demand, all the faculties would have to be ordered simultaneously and harmoniously to each of a variety of conflicting objects in an incomprehensible chaos. Obviously such an adjustment of the organism is impossible. As far as we know, the animal solves this problem by apparently ignoring what is not immediately relevant to his needs. But man has evolved another way of reducing the intolerable chaos of the universe to unity and order, by means of art on the one

hand and philosophy and science on the other. Philosophy and science reduce the chaos to comprehensible abstractions, while art carries on a process of selection and rearrangement for the purpose of producing a desired comprehensible state in which reality may have become almost completely lost.

But why should it be necessary for art to enter at all? Why could not philosophy and science suffice to establish the desired order and harmony in the universe? This paper will suggest, in explanation, that if man's capacity for conscious purposive thought, and his instruments for shaping the universe were adequate for mastering all his difficulties, philosophy and science alone might suffice to establish his adjustment. In the present state, as in all former states, of philosophy and science, after they had been utilized to their limits, much always remains lacking and man's adjustment is never complete. Everywhere, then, art has entered to fill in the hiatus and to attempt to complete the adjustment.[1]

[1]F. C. Prescott, in his *Poetic Mind*, suggests the opposite idea, that primitive associative thought is fundamental and essential, and that conscious purposive thought is a later complement which we could well do without. It is easy to agree with him that as man finds rational thought insufficient, he turns to primitive associative thought as the only other means open for completing the work, and that from this arises art. But it is much more difficult to see why he supposes that this form of thinking leads to greater truth and draws from the well of the race's experience. All that can be said is that apparently more people have thought this way, not out of deliberate choice, but because ignorance of science was, and continues to be, the rule, and that what one does not know or cannot yet know scientifically he romances about in the manner most agreeable to himself, and thus creates art. It seems that Prescott's explanation of the origin of artistic activity, which is wholly sound, inevitably leads to the conclusion that art is essentially secondary to science, and that wherever it has been more important it has become so because the inadequacy of scientific progress demanded a complement, and art had to serve because it was the only one. Artistic activity, he says, arises from primitive associative thought, which is employed because rational thought is found to be inadequate. This inadequacy may arise either from the weakness of the mind or from the difficulty of the task with which it is confronted. The mind may be unequal to its task for various reasons. It may be so because it is naturally weak, as in children or savages; it may be so because it is tired, as reverie arises most often in fatigue, or because it is sleepy or asleep. It may be so because it is in a state of emotion, preventing the adjustment necessary to attentive thought. The subject also may be too difficult, as almost any subject is difficult for the childish or primitive mind. But many subjects are too difficult for any mind—and they are

Thus art may be regarded as a compensation for the insufficiency of reality. At any rate, artistic activity takes its start, at least, in the creative artist from some such felt insufficiency. Philosophy and science must now be examined to see why it is that after they have treated reality a gap still remains to be filled in by art.

Philosophy is an elaborate logical process that attempts to reduce the many to the one, to give an abstract universal that will link the present experience with the total of all experience. Science has the same end in view. Operating by the elaboration of causal connection, it joins every individual piece with the universe of the past and the present. To establish this connection, science must seek the simplest element common to all objects, which is independent of form, time, and change in general. Therefore atoms and electrons are necessary. Thus, by ignoring form and translating diverse objects into terms of a common fundamental element, philosophy and science establish a kind of order, which, whether true or false, satisfies man because it enables him to bring the chaos into some sort of unified orderly arrangement.

From the operation of science laws arise. But law is not an ultimate being. It is not self-executing; it cannot exist alone. It is response, meaning merely that if A changes, B will change. It satisfies the mind by meeting the logical needs of a situation. Law does not engage the senses, and it is not independent of the things which operate in accordance with it, nor is this accordance immediately perceptible. The accordance and the law itself are arrived at only after a logical process, induction, which interposes

particularly the subjects of art in general and poetry in particular. The mysteries of religion, the meaning of life, the secrets of nature, death, immortality, cannot be approached by the reasoning mind. Here art enters to give at least an obscure total impression. Here, surely, one ought to conclude, as Prescott does not, that art begins where science leaves off and that man resorts to it only for want of something to fill the gap, and not because it is a preferable alternative.

itself as a necessary step between an object and its significance. This is an essential characteristic of science, and the cause of the laborious slowness of its development. A first glance at the heavenly bodies, for instance, would not reveal the orbits which relate them to one another. All we see is only bright spots in the sky. To relate them in a system, we must make very difficult and extensive observations and calculations of their gravitational effects on each other. In the same way, to see a white precipitate formed when hydrochloric acid and calcium carbonate are mixed, would not immediately demonstrate the affinity of chlorine for calcium. Each of the new products would have to be analyzed, and the reactions repeated many times and the effects studied very closely. The immediate preception of the white precipitate resulting from the reaction would in itself mean little with regard to the chemical sgnificance of the change. More would have to be known, and this could be learned only by reference to the accumulated data of a vast science.

For another example, suppose one wishes to understand the chemistry of the combustion of a log of wood. He would have to know the composition of the log, of the air, and the laws of chemistry and physics relating to combustion—clearly a difficult and complicated business. He must have a very extensive alphabet, so to speak, in order to spell out this experience scientifically. But if, by contrast, he says, "The fire is eating the log," that is immediate, intuitive, and practically independent of reference to any experiences other than the very simplest. It is poetry; it is art.[2]

Immediacy and completeness of perception of the significance of things are thus necessary and desirable if a man is to make his adjustment to the environment, and if he is to take a proper attitude as quickly and efficiently as possi-

[2]This illustration, though not the application, comes from Prescott.

ble. Philosophy and science work toward this adjustment, but by their very nature they do not at present answer all needs. This is due to the fact that with them the process is not immediate in its results; it is retarded by the intervention of logical induction and by the necessity of discovering and taking into account secondary causes. Here the unavoidable predominance of purposive thought makes the adjustment slow and difficult, a matter of study and comprehension, which is never easy. Reasoning is necessarily laborious and elaborate, and because of this man readily falls back on the imagination, which, depending upon primitive associative thought processes, is easy, immediate, and intuitive, and therefore the faculty of artistic creation.[3]

From this it must not be thought that art is a substitute for the logical realities of science. It is only an addition rendered necessary by the pecularities of the human mind and by the limitations of human knowledge and power. It recognizes that the apparent universe is not the desired one, and so operates as to reconcile the incongruities between the two. Santayana has suggested that all ideas have their origin in inner or outer maladjustment. The ideas of art are, too, a consequence of this maladjustment, but they are different from the other ideas, for art begins where the other activities leave off. It is easier because intuitive and not based upon logical thought, and produces immediately and completely within its own sphere the adjustment which is elsewhere the result of the total activity of rational

[3]It ought to be made clear at once that whenever artistic creation or experience is spoken of in this paper, what is meant is the process occurring in the creative artist himself, and more particularly in his mind. The subsequent material record of this experience in the form of words, sounds, colors, or forms is important only as an attempt to recapture a fugitive memory. The essential thing is the mental operation that leads to the created artistic object, which may serve the double purpose of satisfying the artist's need of expression and of enabling the beholders to adumbrate—always much more weakly—his experience which is here recorded in its full meaning only for him himself. This makes of the aesthetic experience proper a very personal thing to be found in its purest form in the persons of the greatest artists themselves.

thought. Thus everyone is an artist, but as the technique of expression is rare and difficult, physical embodiment of the artistic experience does not always result.

With the act of perception art seems to create an adjustment which, more than that of nature, philosophy, or science, establishes harmony with human interests. This is due to its immediacy, completeness, and independence from all extraneous considerations such as truth and practical utility. But in addition to these essential qualities, art may have a variety of incidental qualities that are of no aesthetic consequence. It is often interpenetrated by outer interests. Thus, the pictures of Uccello, who in 1395 gave himself fanatically to the study of the new science of perspective, may have meant to him consciously only so many feats in foreshortening and experiments in perspective. Similarly, the modern Dadaist may see in his paintings a philosophic device for overthrowing an unsatisfactory civilization. But in each case, if the works possess the required immediacy, completeness, and independence, they are genuinely artistic, despite the artist's expressed scientific or philosophic intention.

If it is the aim of philosophy and science to remodel discordant nature into harmony with human nature, as it is the aim also of art, wherein lies the difference? It lies in the acknowledgment by the arts of the value of immediate experience and feeling, however induced, without reference to or the sanction of practical reality. It accepts experiences and desires as they come, in and for themselves; eliminating, adding, and rearranging the materials that can best represent the desired values in concrete terms of sense. This process, as will appear in the development of this paper, depends upon the predominance in art of the more primitive process of associative imaginative thought, as contrasted with the purposive rational thought of science. What follows here will be a detailed examination of the

distinguishing peculiarities, so far only named and barely characterized, which separate art from other activities.

* * * *

It is first to be noted that art employs, at least as a starting-point, matter, and deals with materials which have been apprehended through the senses and which manifest themselves in the memory. But it must be added that in art these sensory images or memories are dealt with in a peculiar way. They are not arranged at all by reasoned thought, but by more or less spontaneous association, which is a way of liberating experience from scientific laws. Rational thought is more directly related to sensuous experience. It is carried on while the senses are active, and deals with the materials they immediately furnish. Primitive associative thought, however, depends more on sense memories, and is most effective when the senses are not vividly alert. To this end revery, dreams, alcohol, narcotics, falling in love are recommended, because they relax the attention to life and permit a free and unimpaired arrangement of imagery to meet the peculiar and personal needs of the artist. In some such condition lies poetic madness or vision.[4] Shelley, for instance, composed best with his head close to a fire or in the heat of the Italian sun. And the use of narcotics by many artists, such as Coleridge and De Quincy, is universally understood. At any rate, the important thing here is that before aesthetic experiences can occur, particularly those associated with the creative process, the artist must by natural or artificial means induce a reversion to imaginative thought, as contrasted with rational purposive thought.

Immediacy, completeness or independence of the practical realities of the environment, and a use of the accumulated sensory data have been indicated as the characteristics of art. The immediacy and completeness arise from the

[4] F. C. Prescott, *Poetic Mind*, p. 66.

internal activity of composition, which so selects and arranges the parts that they form for the artist, even if for no one else, a unified whole, free from conflicts and irrelevancies, and likewise liberated from the necessity of making external reference, which is so essential to science. These characteristics endow the creation with independent unity and coherence. Such coherence, realized by means of a process of unhindered arrangement, is the fundamental ingredient of art.

From this we can define coherence as that which gives to the artist an immediate perception of the mutual interdependence of the parts of his composition, without reference to the past or the future, and without reference to causal connections or to external scientific laws. This would allow aesthetic qualities to that which violates natural laws, as a shadow on the wrong side of a house, or a human figure with wings, or a Medusa with snakes for hair.

Immediacy, the first of the qualities which go to create this coherence, appears most clearly when contrasted with scientific phenomena. We have seen that in science things win significance not directly in and for themselves, but through the mediacy of an intervening law, which it is the business of science to discover. The establishment of such a law is a deliberate selection from the chaos of experience. No particular object means anything unless it can be referred to many others and to laws. But in art all that is not immediately given and apprehended does not belong at all; it is ignored as irrelevant. A specific example will make this clearer. A scientist seeing a sunset understands by means of the laws of refraction why the sun looks bigger and redder and knows that its apparent drop is due to the motion of the earth and not of the sun itself. All this is scientifically true and valuable, but entirely indifferent for apperceiving the sunset as it appears to us. The primitive savage who says that it gets gorged with blood as it drops

UMI

in the heavens and that it sinks and is extinguished in the cold blue ocean, is aesthetically the more truthful, because he is giving that which we really do see immediately and without the necessity of reference to external laws.

Completeness resulting from the felt interdependence of the parts is the second aspect of aesthetic coherence. The artist feels, without the necessity of reason, that these parts do properly and of right belong together; the arrangement satisfies him. This leads to a stronger attention to the beautiful object than is given to ordinary things, and so engrosses the artist in the resulting train of associative imagery that all other considerations are excluded, even the self of the observer. One can, for example, become absorbed in a painting by Van Gogh of an incandescent Provençal sun, but not in the sun itself, were its rays burning down on one's bare head. The painter was able to tolerate the sun, as perhaps another could not, because he was rendered oblivious to it by the train of associative imagery which it set in motion. Also his attentive effort to reproduce this imagery on canvas helped to engross him. Should another expose himself to the same sun, it is more likely that he would be conscious only of the heat and discomfort than that he would experience Van Gogh's train of imagery, launched, so to speak, by the sun, and reproduced on canvas by the artist. By means of the painting, with its sweating laborers and drooping oxen that may not have actually been on the field at all, others can, but to a very much less intense degree, understand something of what the molten vibrancy of that sun meant to Van Gogh. The sun as a cause of distracting discomfort is now removed by the artist. This is, so to speak, an artificial aid to the observer, whose reaction, if he saw the sun itself, would lack Van Gogh's emotional coloring to neutralize the discomfort. Nor could it mean the same, or as much, to him, because he could not bring to

it Van Gogh's particular experiences.

This indicates why the absorption which excludes all externality is so important in art and why it is so much more intense in the artist than in any observer of his works, and it gives ground for the insistence on the purely personal nature of the aesthetic experience. It is in the nature of the case that only one person, the artist, should experience it most intensely and most nearly completely. It is in the phantasy, the dream, or the free associative process—set off by whatever external stimulus you will—that art lies. Furthermore, the representation is not important. It has to do with another activity, the desire to express one's self. At best the representation is only an imperfect embodiment, and that is why the artist is so rarely fully satisfied with his work. These considerations indicate that by the use of mere abstract symbols, as in music, the artist might more satisfactorily to himself succeed in setting down his thought. Modern pictorial art has taken this path; but its weakness is that as the symbols lack intelligibility, the work will mean little or nothing to the observer, though to the artist it may be rich in meaning.

The essential fact here is that in the aesthetic experience the necessary engrossment in the primitive thought process and the obliviousness of the external world, are a result of the innate and thoroughly satisfactory coherence of the parts. For the time a completely desirable world has been established, without a discord. The artist experiences it automatically at the chance occurrence of a given stimulus, the sight of a person or a cloud, the sound of a wind, or the odor of a flower. The resulting desire to incarnate the train of associative imagery which follows the original stimulus is an incidental piece of good fortune for other people, who, given the composed and artificially isolated work of art, may attempt to adumbrate the artist's experience if there is any common ground between them, and, happily,

UMI

there is often a great deal. The fact to be observed here is that this inner agreement is the deepest characteristic of everything aesthetic, and is quite different from the unity of causal connection to be found in science; and that in its purest form, namely in the artist, it springs from a process of primitive associative thought that is initiated by a stimulus.

Thus we see that just as science connects, so art isolates its materials; and just as science requires the aid of causal interconnection and laws which postpone the perception of immediate relationship of things, so art operates immediately and independently of outside considerations. Consequently the simplification of science is a slow, laborious process, connecting an object with the universe of the past and the future; while art is a facile and immediate process which creates a self-sufficient object detached from the remainder of the world.

There still remains the question of why the experience of the peculiar coherence which has been here described and characterized as the essential of aesthetic activity should have value for us. If we remember, however, that significance is of necessity sought for each object in the environment, so that the organism may take toward it a satisfactory attitude, for the sake of survival, and that man has two mental processes by which to effect this, we may get a clue to the particular value of aesthetic activity or coherence. Man has only a limited amount of power and so can accomodate himself physically to a strictly limited number of objects at one time. He is therefore obliged to select and reject, in a word, to compose his world, in order to establish some kind of comprehensible unity and coherence. In this way he finds a cementing principle to bind together a diversity of objects and to make them intelligible as a group. When he becomes aware of this intelligibilty, all his faculties can then take an integrated attitude, just as they do

automatically toward food or danger, which merely happen to be more urgent and fundamental than the others, and therefore have developed a readier and fuller response. In art, as contrasted to science and philosophy, this cementing principle is more easily and quickly established by the primitive association of images, which, being already innately unified and related, automatically and unconsciously eliminate all inharmony.

Therefore, art can be said to possess a survival value, related to, but less important than, biological activities, like food-getting.[5] The extreme function and value of art lie in such a statement as when we speak of realizing our wildest dreams. This explains the paradox that while art grows out of biological roots, its value increases as it roams farther and farther away from biological reality. This suggests, too, that as our wildest dreams tend more and more to become realized by science, the necessity and value of art will suffer a corresponding decrease. Science constantly encroaches upon art in this way, and may eventually completely supplant it. There seems to be some evidence of this already. We are more impersonal and less poetic toward a sunset, now that we no longer have reason to entertain such myths as that a monster swallows the sun each night, or that it is driven up in a chariot each morning. With the development of aviation, the poetic possibilities in the flight of birds will be considerably diminished. With ampler food supplies and better distribution, Isaiah would never have sung as he did in xxix, 8, "And it shall be as when a hungry man dreameth, and, behold, he eateth . . . . or as when a thirsty man dreameth, and, behold, he drinketh." In the case of eunuchs, it may be properly said that as science has closed one avenue of desire, it has also closed one avenue of artistic expression, in the form, let us say, of love poetry.

[5]Less important than food-getting, because an aesthetic experience of poor quality, or the complete absence of all aesthetic activity, would hardly be as fatal to human life as the absence of food or the presence of wild animals.

UMI

It is inconceivable that unfulfilled sex desires, which are recognized as a dynamic source of art in normal people, should ever lead a eunuch to write such lyrics as Robert Burns wrote when separated from his mistresses.

Primitive man thought mostly in images, and hence lived largely in the imagination. But imagination is called upon to do less as reasoning and science become stronger. This has been recognized; Macaulay, for instance, asserting that "as civilization advances poetry almost necessarily declines." Thus with the development of analytic thought and science, the problem of adjustment will be more and more rationally solved, so that fantastic thought will tend to become less and less necessary as a complement. If science should discover a way to prolong life indefinitely, man would probably lose his interest in religion and other poetic conceptions of immortality. But it is quite conceivable also that with the satisfaction of each new demand, man would will and imagine something still different and newer. In that case there would be an infinite development of science, paralleled by an infinite procession of unfulfilled desires, which would pass from the realm of art to that of science as they each became realizable.

As long as there will be unsatisfied desires, whether old or new, the function and value of art will remain the same, because through it, by means of facile associative thought, we enjoy a lulling substitute for the abilty to control nature instantaneously and at will.[6] And its value becomes the greater as it gives us combinations which, because of the peculiarities of artistic coherence, tend more and more toward the unreal.

A. E. FREEMAN

ROXBURY, MASS.

[6]The artist seldom or never merely describes nature. He inevitably beautifies and glorifies it—diverts it from reality. The moment he modifies he does so not at random, but in accordance with his desires. Instead of describing the present reality, he looks through his desires to the one hoped for.

PLATO'S THEORY OF BEAUTY

WE DO NOT find any conscious reflections upon the nature of beauty in extant Greek literature before Plato and Xenophon, that is before Socrates. But the sense of Beauty was always the distinctive quality of the ancient Greek, and if we wish to have a clear idea of the aesthetic experience of Plato's contemporaries, we must turn to Homer. There we find that the word "beautiful" refers primarily to the beauty of the physical world, i. e., beauty as *seen* by us, and especially the manly beauty of the youthful hero who is, as Priam says, always beautiful, even in death.[1] The beauty of nature is not ignored, but references to this occur most often in metaphors or similes, where the chief interest is still centered upon the human actors. Nature to Homer, as to the Greeks in general, is but the frame, with man as the picture. Of moral beauty we find little, and even where certain actions are called beautiful, they are considered aesthetically. Homer's attitude may be best expressed in the words used by Santayana: "Where the absence of these virtues (i. e. honour, truthfulness and cleanliness) causes an instinctive disgust, as it does in well bred people, the reaction is aesthetic, because it is not based on reflection and benevolence but on constitutional sensitiveness."[2] Where

[1] *Iliad*, XXII, 71. Perhaps the nearest approach to a definition of "beautiful" that we get in Homer is his description of the natural beauties of Calypso's isle, "even an immortal god who came there would wonder at the sight and rejoice in his heart."

[2] *The Sense of Beauty*, p. 31.

UMI

Homer says of an action that it is "not beautiful", he means that a breach of this rule is ugly, in so far as it causes pain to the spectator.

In the same way, where works of art or songs are called beautiful, it is especially their spectacular value that the author has in mind; not their moral value or their technique.[3]

Such is the sense of beauty in Homer, and we must remember that every young Greek was taught to look upon the Iliad and Odyssey not only as an artistic heritage, but as a moral and spiritual guide.

It is in the lyric poets that we first find the moral aspect of beauty emphasized. In this they were followed by the tragedians and philosophers. The word καλός comes to be used more loosely and the distinction between the good and the beautiful is obscured. It is interesting to note that the adverb καλῶς, which occurs only once in Homer,[4] is now used as much and with as vague a meaning as our own adverb "well", and that phrase καλὸς κἀγαθός, beautiful and good, now comes into fashion as the ideal Greek gentleman. We shall see that it remained Plato's ideal to the end. This tendency to identify Good and Beauty, which is completed in Plato, was a natural result of Greek humanism, and it led to the further identification of Beauty and Usefulness, for throughout their literature, from Homer downwards, the Greek conception of Good was strictly utilitarian. Nevertheless even in fifth and fourth century Athens, the average man did not keep pace with the meditations of poets and philosophers, and he continued to use "beautiful" more in the Homeric sense.

Traces of this popular usage are not wanting even in

[3]For numerous references, see J. Walter: *Geschichte der Aesthetik im Klass, Altertum*, (1893) pp. 18 ff. and notes. He also works out in detail the development of the useful or moral aspect of beauty in Greek thought.

[4]In *Odyssey, II*, 63.

Plato.[5] The conception of the beautiful as useful had affected the average mind only to the extent of preventing obviously harmful things being called beautiful. From the point of view of aesthetic reflection, we must distinguish two periods in the writings of Plato. In the first, to which belong the *Gorgias* and the *Hippias Major,* he attempts to explain and crystallise the common aesthetic experience of his day. In the second he develops his own ideas of beauty, but without in any way rejecting the results previously obtained. The most important dialogues of this second class are, for our present purpose, the *Republic,* the *Phaedrus,* and the *Symposium,* the *Philebus* and, to a certain extent the *Timaeus.*

Socrates, in the *Gorgias,* in the course of an argument to prove that it is better to suffer wrong than to do it, defines a beautiful thing as that which either is useful or gives pleasure to the spectator (i. e. to the person who sees or hears it.)[6] This definition is accepted without discussion and the argument proceeds. So far we have two causes of beauty, usefulness and pleasure.

The *Hippias Major* is a short dialogue of which the purpose is to make clear the fundamental ignorance of Hippias of Elis, the great sophist who boasted to be an expert in all departments of knowledge, by showing that he cannot even give a satisfactory account of such a simple thing as beauty. The Platonic authorship of the little work has been doubted, but without sufficient reason. Socrates first rejects three suggestions of Hippias, namely that beauty is: (a) a beautiful maiden, (b) gold, (c) a happy life, prosperous and beautiful until death. In discussing these proposed definitions, Plato has an opportunity of explaining in detail the

[5]Such as the difference between *καλός* and *καλὸς κἀγαθός* in *Lysis* 207 a; see also *Ion,* 530 b; *λαμπρότατον ἰδεῖν καὶ κάλλιστον, Timaeus,* 40 a, (most shining and beautiful) of fire and the frequent use of *καλός* of phyysical beauty, e. g. *Phaedrus* 237c, 238c, 243c.

[6]*Gorgias,* 474, d-e.

difference between particular examples of beauty and beauty in general. But it is the latter part of the dialogue which is especially important for us. Socrates here suggests three definitions of beauty which, for the sake of politeness, he puts into the mouth of an unnamed speaker who is no other than himself. Beauty is (a) the suitable or fitting (τὸ πρέπον); (b) the useful (τὸ χρήσιμον), which is then restricted to what is useful for a good purpose, which we will call the advantageous (τὸ ὠφέλιμον); (c) the pleasing to eye and (or) ear (τὸ δί' ὄψεως καὶ ἀκοῆς ἡδύ).[7] None of these definitions is accepted and the *Hippias Major* ends without answering the question, What is the beautiful? But it clearly enunciates three aspects of beauty which Plato, in all his further discussions of aesthetic experience, will attempt to reconcile. In the last two definitions, the advantageous and the pleasant to eye and ear, we recognize the two parts of the definition given in the *Gorgias*, but with a difference. Not only are they more completely explained, but each is examined in turn to see whether it can account for all beauty, i. e. whether we can reduce beauty to a single conception, a common quality, corresponding to the common predicate and justifying our calling beautiful all those different objects and actions to which, as a matter of fact, we do give that name.

So far Plato is only giving expression to the common Greek feelings about the beautiful. It is important to note that in neither of the two dialogues referred to does he make any use of the theory of ideas. Not a single expression either in the *Gorgias* or the *Hippias Major* need imply that Beauty has any existence of its own apart from the particular objects in which it appears. Not so in the *Republic*. There Beauty is, like Goodness, Justice and the like, a fully fledged Platonic "idea". It has left the world of becoming

[7] *Hippias Major*, 293e; 295c-296e; 297e ff.

to inhabit that of Being or Reality. As such, it is apprehended by the mind, and the beauty of which our senses are aware is but a vague reflection of it. We had already been told in the *Hippias Major* that any beautiful particular is only relatively so, just as a beautiful maiden, when compared to a goddess, may equally well be called ugly.[8] This is again emphasized in the *Republic* where it is proved that all so-called beautiful things are also ugly. This much even the man who fails to apprehend absolute beauty is compelled to admit. The philosopher, with the aid of knowledge, apprehends that absolute beauty which dwells in the world of Reality and is the only true beauty, for it is the only beauty that can be known. The beautiful phenomena, on the other hand, being in a world of change and flux are the objects of opinion, not of knowledge.[9]

But that ideal Beauty still manifests itself under the same aspects: suitability, advantageousness and pleasure of sight and hearing. Plato develops each of these in his works and in tracing that development there is in each case an obvious tendency to lead beauty away from the senses to the intellect.

(a) The fitting or suitable is not defined in the *Hippias Major,* as the advantageous is. Indeed, Plato does not seem to be at all clear what is the difference between the two. When he tells us, for example, that a ladle of figwood is more suitable than one of gold both because it gives a better flavour to the broth and is not likely to crack the turreen, it is clear that these reasons also make the figwood ladle more useful. But although he does not express himself clearly here, by "fitness" Plato must mean harmony, which he often refers to as a cause of beauty elsewhere. And the perception of harmony means the perception of unity in variety, of the one in the many which has been called "the

[8] *Hippias Major,* 289a.
[9] *Republic,* 475a-479e.

UMI

one true aesthetic principle recognized by antiquity in general."[10] How close this connection between harmony and beauty seemed to Plato can be seen from the number of times the two are used almost synonymously. They are said to be identical in the *Symposium*,[11] and in the *Philebus*[12] measure is that which through its admixture with the indefinite substratum, produces both the beauty and strength of the body and the superbeauty (παγκαλά) of the soul.

It was an easy step from harmony to measure, for to Plato harmony meant moderation. Justice, which we are told elsewhere is always beautiful,[13] is understood throughout the *Republic* to mean moderation and self-control, both in the individual and in the state. Each constituent part of the soul or state should find the place for which it is suited and keep to it. So in the *Timaeus*,[14] which is written under Pythagorean influence, measure or number is the only thing that makes knowledge and time possible. The sun and the stars have been created for that purpose, for without them there could not be time. To possess intelligence or reason is to share in or apprehend number.

Although Plato nowhere gives a full account of his aesthetic, the conclusion is clear. Thanks to the presence of measure or number working upon the indefinite substratum, the universe is a harmony. This ordering of the cosmos through number accounts for the beauty of the world—it is Beauty itself. For Plato never questions the beauty of the world.[15] Truth and Beauty are thus found to be two aspects of the same reality, and inseparable.[16]

Neither does the beauty of man depend on the soul

[10]Bosanquet: *History of Aesthetic*, p. 30. For beauty as "suitability" see Plato, *Alcib.* I, 135b, c; Aristotle, *Topica*, 135a, 13 and *Nicom. Ethics*, 1122b, 8f; also Homer, *Iliad*, XXII, 79; *Odyssey*, VII. 159, etc. The importance of "Harmony" in Pythagorean philosophy is well known.

[11]*Sympos.*, 206d.

[12]*Phil.*, 26a-b.

[13]*Laws*, 859d. ff. on the identity of justice and beauty.

[14]*Timaeus*, 38b. ff.; see also *Epinomis*, 977c.

alone, or the body alone, but upon the harmony of both. The following passage is a timely reminder that Plato never lost his sense of proportion. The "beautiful" man must take care of both body and soul:[17]

"All good is beautiful, and beauty is not without measure. If we are to attribute this quality to a living creature, it must have measure. We perceive the smallest kinds of "harmony" and remember them, but the greatest and most powerful we neglect to compute. For no "harmony" or discordance is more powerful to effect health or illness, virtue of wickedness, than that between the soul itself and the body itself. This we altogether fail to see or understand: that when a soul that is strong and great in every way has to rule an inferior body, or vice versa, the whole creature is not beautiful—for it lacks the greatest harmony, but the creature that is in the contrary state is, for him who has eyes to see, most beautiful and lovely."

(b) The main difference between the advantageous and the fitting is that, while the latter is complete in itself, being a relation between two objects as perceived by a subject, the former has an end in view, namely the Good. But a study of this aspect of beauty led Plato in a similar direction as the first. This second definition is rejected for a curious reason, which Plato apparently believed to be sound.[18] If, says Socrates, the advantageous is the cause of the good, it cannot be identical with the good, which we know it is, for the beautiful is good. The idea of beauty as "the father of the good" is a notable one. The *Hippias Major* was written at an early stage in Plato's life before the use of the predicate, i. e. the difference between: "Beauty is good", and "Beauty is the Good", was clearly understood. The question of the copula is dealt with in the

[15] *Timaeus*, 29a.
[16] *Philebus*, 65a.
[17] *Timaeus*, 87c. ff. The word I have translated harmony is *συμμετρία*.
[18] *Hipp. Maj.*, 297c.

Sophist after which the *Hippias Major* could not have been written.

That beautiful means useful is frequently stated, both by Plato and Xenophon.[19] It appears then to have been accepted by Socrates. But it is probable that his shrewd common sense led him to see the inherent difficulties of this theory. As he says in the *Symposium* of Xenophon,[20] if beautiful eyes are those that see best, then his own eyes are more beautiful than those of Critobulus because they project further out of his head and have therefore a wider field of vision. Quotations from Plato could be multiplied from almost all his dialogues to show how deeply the usefulness of beauty was rooted in his mind. Even in the *Symposium,* where it has been said that Beauty is the ultimate object of desire and thought, we should not forget that love has not Beauty for its ultimate object but creation in Beauty.[21] This conception remains with Diotima throughout her speech. The child of Beauty and Love is virtue. When in the *Timaeus*[22] Plato says that the most beautiful bodies are the isosceles right angled triangle and the right angled triangle which is half an equilateral, he is not thinking of these triangles as being the most aesthetically pleasing but as being capable of the most varied combinations, and thus the most useful to the Creator.

It is this view of beauty which is directly responsible for Plato's views of art in the *Republic* and the *Laws.*[23] The value of artistic achievement is to be sought, we are told, in its effect upon men. It is beautiful in so far as it makes them better. It would be an advantage if it could be stereo-

[19]Xen., *Memor.*, III, 8, 2-8; IV, 6, 8-9. Plato, *Rep.*, 402c; *Phil.*, 50b; *Timaeus,* 31e; etc.

[20]Xen., *Symp.*, V, 5. Note that "eyes" are the first example quoted to prove the usefulness of beauty in *Hipp. Maj.*, 295c.

[21]*Symp.*, 206 c and e.

[22]*Timaeus,* 53e.

[23]*Rep.*, 377b-403c; and 607ff; *Laws,* 655 b, ff.

typed like that of the Egyptians.[24] Being purely didactic in purpose it must avoid all excess and must only imitate those sights and actions which will make men better. Should the artist refuse to comply with these regulations we must bow him out of the state. This crude utilitarianism is shown best in the *Lysis*[25] where Socrates says—quite casually—that no one would of course consider himself a good poet if his poetry brought him harm, although we must remember that to Socrates, the man's own good and that of others was identical.

We have here then what is often attacked under the name of "the moralistic fallacy" in art criticism. "The moral and practical judgment," says Bosanquet,[26] "is the first intellectual outcome of practical life, and is inevitably turned upon the world of beauty, so long as it is undistinguished from the objects which constitute the means and purposes of real action." But it is a bold statement that separates the world of Beauty from that of real action, whatever the latter may be, and Plato is right at least when he says that the Good and the Beautiful cannot be incompatible. As Dean Inge has said:[27] "Plato would banish all poets who are not edifying: his test of good music is its effect upon the moral character. This confusion of two standards undoubtedly led the Greeks, and perhaps Ruskin too, into some errors; but the ultimate identity or at any rate perfect harmony of the good, the true and the beautiful, is an article of faith which will help a critic more than it hinders him." There are things that are banished from the stage by common consent at all times. The difference between Plato and us is only one of degree. Ultimate harmony of Good and Beauty is all that Plato claims. Just

[24] *Laws* 817b.
[25] *Lysis*, 206b.
[26] *History of Aesthetic*, p. 18.
[27] "Ruskin and Plato," in *Ruskin the Prophet and other Centenary Essays*, 1920.

as the four cardinal virtues, courage, moderation, wisdom and justice are different and yet cannot be separated from one another,[28] in the same way Beauty and Good are one and yet many. We cannot conceive or explain the Good, except in terms of Beauty, Measure and Truth, says Plato in the *Philebus*.[29] And we have seen that Beauty and Measure or Harmony are usually spoken of as identical. There is an interesting passage in the same dialogue,[30] where Plato speaks of absolute beauty in the following words:

"I am now trying to explain to you a beauty of forms which is not what the majority would interpret it to be, namely that of living creatures or of pictures; I mean something like the straight or the circular, and the planes and solids that are made by means of them by lathes and rulers and instruments to measure angles. These things I say are not beautiful *in comparison with* something else, but they are in essence beautiful always and absolutely, and give certain pleasures of their own, which have nothing to do with the pleasures of scratching; and there are colours which are of the same kind. Do you understand?"

By "pleasures of scratching" Plato contemptuously refers to physical pleasures. The expression I have translated by "in comparison" with could, in another context, mean "with some ulterior end" (πρός τι). But that would give altogether the wrong sense. Plato does *not* mean that these "forms" have no other end than beauty, as for example that they do not lead to good, as he quite clearly says a little later that the pleasure provided by the contemplation of these "forms" (σχήματα) do lead to good.[31] He is contrasting their beauty with that of the phenomena. By

[28]On the unity of virtue, *Protagoras*, passim; also *Laws*, 966a—where they are compared to Good and Beauty.

[29]*Phil.*, 65a.

[30]*Phil.*, 51c.

"form" he means the concept circle which does not vary whereas particular circles or lines undoubtedly do. Any particular phenomenon is no more beautiful than it is ugly, and a fairly well drawn circle is beautiful in comparison to a worse and ugly when compared with a better drawn one. No particular circle is perfect. But what we see in circle and what gives us delight is the beauty of the circular form which is always beautiful wherever it occurs. These forms are somehow intermediary between the particular phenomena and the supreme ideas, in the "line" in the sixth book of the *Republic*. Plato implies for "forms" what he definitely states of sound: that the most simple are the most beautiful.[32]

That is doubtless a reflection of genuine aesthetic value. But Plato's reason for this statement probably was that the simplest things are the basis on which the rest are built. Just as the simplest "forms", the two kinds of triangles in the *Timaeus*, are the most beautiful because they are the most useful in constructing other figures.

(c) Beauty is what is pleasant to eye and (or) ear. This is the third definition suggested in the *Hippias Major*. Its importance lies in the fact that it is a hedonistic view of beauty, and an advance upon Homeric beauty which nearly always appeals to the eye only. It is rejected because Plato fails to find in what these two kinds of pleasure are different from all the others. In other words, he fails to discover why they, and they alone, are beautiful. He comes very close to his later theory of the "pure" pleasures when he suggests that they are the most harmless.[33] But confusing, as he frequently does in his early writings, the negative and the contradictory, he takes harmless as meaning advantageous, and the objections made against the second definition are then valid once more.

[31] *Phil.*, 54d.
[32] *Phil.*, 51d.

The problem is solved in the *Philebus*.[34] Plato there divides pleasures into pure and impure, the former being the beautiful pleasures. By "pure" he means pleasures which are unmixed with pain. Drinking is an impure pleasure in this sense, because the absence of it, i. e. thirst, is painful, but the pleasures of sight are pure because the absence of them is not accompanied by pain. The characteristics of the pure pleasures, which are also the beautiful pleasures, are that (a) they are free from pain; (b) they are caused by things beautiful in themselves; (c) which are always beautiful; (d) they are moderate (lit. have measure). They include the pleasures of sight, those of hearing, most pleasant smells, and the pleasures of the intellect.

There is a similar division of pleasure in the *Republic*,[35] where Plato is proving that pleasure and rest from pain are not identical, although the majority of men not unnaturally confuse the two. The sense of smell is again brought forward as proving the existence of positive pleasure, as not being preceded by pain. The most pure, and therefore the most real, pleasures are those of the soul. These are practised by the philosopher, and his life is filled with the best and truest pleasures.

It is while discussing the hedonistic aspect of beauty that Socrates says to Hippias:[36] "Everybody would laugh at us if we said that eating is not pleasant but beautiful, and that smelling is not pleasant, but beautiful. And all men would maintain against us that the pleasures of love are the most pleasant of all, but that if anyone practises them, he must so do it so that no one sees him, as being most ugly to behold." The idea that anything for which man requires

[33] *Hipp. Maj.*, 303e.
[34] *Phil.*, 50d ff.
[35] *Rep.*, 583b-587b.
[36] *Hipp. Maj.*, 299a. A similar confusion occurs in a different connection in *Gorg.*, 475b.

privacy is necessarily ugly rests on a confusion between the feelings of the actor and those of the spectator. A poet seeks to be alone to write his masterpieces, yet it is not displeasing to see a man writing verse. A different confusion is found in *Philebus*[37] where Socrates says: "When we see anyone enjoying pleasures, and those almost the greatest, realizing that they are attended by ridicule and shame, we ourselves are ashamed and hide them as much as possible, practising all these by night, thinking that daylight must not see any of these things." Here the feelings of the spectator are mentioned, it is true, but only his sense of shame, not his aesthetic appreciation. This shame is really sympathy with the victim. We know that he will dislike being seen and feel awkward in consequence. The truth is, of course, that the desire one may have to be alone to enjoy certain pleasures of love or art has nothing to do with the aesthetic value of the act. This should be judged on its own merits.

Suitability or Harmony, Good or, more strictly speaking, the cause of Good, the "purest" of pleasures: such are the three aspects under which Beauty appeared to Plato. But how was it to be approached? In what way can we hope to apprehend it?

To Plato, both aesthetic satisfaction and the student's longing for Truth were parts of Love. Love has for its object Beauty, or rather, as we saw, Creation in Beauty. This sublimised love is described in the *Phaedrus* and the *Symposium*. The first of these two dialogues, in which we may see a strong tinge of Orphism, depicts the soul, before it is imprisoned in a mortal body, striving to follow the gods in their course and to catch at least a glimpse of the ideas which have their being outside the world of becoming. If successful they behold Beauty, Truth and Goodness, and this sight causes the wings of the soul to grow.

[37] *Phil.*, 65e-66a.

But there is such a crush and confusion of souls competing for a place in those higher regions that many lose their wings, and are filled with evil and forgetfulness. But even on this earth the best of them seek to regain that vision which they have lost, and these are the philosophers. The function of Beauty as expressed by the phenomena is to remind us of the absolute beauty we have imperfectly seen, and the lover of beauty feels his wings growing once more, at the sight of this reflected beauty, wings which will lift him again into the sight of beauty itself, and rejoices. But everyone loves according to his character, which is modelled upon that of the god whose follower he was while journeying on high.[38]

This upward journey is fully described in the *Symposium*:[39]

"For," says Diotima, "one who follows the right path must begin as a young man by going to beautiful bodies, and first if he is properly led, he loves one body and from this he gives birth to fine thoughts, then he sees that the beauty of any one body is sister to that of any other and that, if he is to pursue physical beauty, it is great foolishness not to believe that the beauty we see in all bodies is one and the same thing. When he understands this he is the lover of all beautiful bodies, but he abandons that violent desire of a particular one, despising this and thinking it of little weight. Later he considers the beauty of the soul to be more precious than that of the body. In consequence any one with goodness of soul gives him satisfaction. Such a man he loves and cares for, and he seeks and expresses such words as make young men better, in order that he may be forced to see the beauty of laws and moral customs and understand that all this beauty is akin, and to think that bodily beauty is of little account. And after customs he

[38] *Phaedrus*, 246a-253c.
[39] *Symp.*, 210a ff.

must be led further to the beauty of the sciences, that seeing beauty in many things and no longer that of one only, with a menial love for the beauty of some youth, either of one man or one custom, himself a mean slave and of no importance—but, drawing towards the ocean of beauty in many things, and gazing upon it, he expresses many beautiful and magnificent thoughts and conceptions in abundant philosophy.

There he increases in strength and power, until he sees one such science, which is of this beauty."

The man who reaches the end of this journey "will suddenly perceive something marvellously and inherently beautiful, that very thing, Socrates, which was the goal of all his previous labours. Something which, firstly, always exists, which does not come into being and is not destroyed, does not increase or fade away, which is besides, not beautiful in a certain way, and in another way ugly, not beautiful at a certain time and not at another time, nor is it beautiful in relation to one thing, and ugly in relation to another, nor in one place beautiful, and in another place ugly, nor beautiful to some men, and ugly to others. Beauty will not appear to him as having a face, or hands, or any part of the body. It is not some particular reasoning or some particular science. It is not contained in something else, as if it were in a living being, or earth or heaven or anything else, but it is by itself, of itself, and always of one kind."

Such then is the Platonic idea of beauty: it is the harmony of the world which is the result of the introduction of measure or number by intelligence; it is inseparable from Good, and is perhaps best described as the cause of it, though the two are but aspects of Ultimate Truth, and the contemplation of it gives the most real pleasure, because the most lasting and the most "pure".

What exactly is the relation between the supreme

Beauty, which seems to live in a world so far removed from that of everyday life, and phenomena? Plato does not clearly say. The question is the same for the whole world of Platonic ideas and is really a metaphysical one. It is the old problem of the influence of mind upon matter.

It still remains for us to find a satisfactory reason for Plato's severity towards the poets.

In the *Republic*[40] he divides the Universe into four classes:

(1) images, such as reflections in a mirror, etc.,
(2) the phenomena,
(3) scientific formulae arrived at by hypothesis, and
(4) supreme truths or ideas.

These four classes are each more real than the preceding. The first two are apprehended by sense perception and opinion; the last two are objects of knowledge. Now the products of art are included in the first class, as imitations of phenomena. All the artist can do, therefore, is to reproduce as exactly as possible certain particular occurrences, and his greatest masterpiece will still be "three times removed from the truth."[41] It is important to realize that this view, although consistent with, does not necessarily follow from Plato's utilitarian view of Beauty. Even if the purpose of art is purely didactic, why should not the great artist imitate, or reflect, the ideas, in the same way as the phenomena themselves?[42] We are told that Plato condemned poets because the fourth century artists were bad, but that would not have blinded him to the merits of poetry as a whole.

It is also true that great art is intensely individualistic. A tragedy is as much concerned with the peculiarities of its hero as with his resemblances to the rest of mankind. Hamlet and Lear are like nobody else, real or imagined. But

[40] 509d ff. For a full explanation of this division see J. Adam's notes ad loc.
[41] *Rep.*, 509a.

then, the natural phenomena are equally individualistic, and yet they reflect, and "in some way" share in the idea.

The real reason will be found in Plato's own aesthetic experience. There can be no doubt that he found works of art aesthetically pleasing. [43] But it is noteworthy that the passages which show a real appreciation of artists, apart from their value as teachers, and which grants them a "divine" inspiration occur in the earlier works.[44] The *Ion* is a typical example, for in that dialogue Socrates says that great poems and songs are written under direct inspiration from the Muses.[45] And this poetical frenzy is to a certain extent passed on to the hearers, through the intermediary of the rhapsode. The poet is compared to a magnet that can pass on its power to what comes in contact with it. But he has no knowledge of what he writes. This absence of knowledge is often insisted on. That these products of the artist are beautiful is, however, unquestionably asserted.

But in his later works Plato insists more and more upon the intellectual side of Beauty, and uses the word beautiful more sparingly of works of art, though they are of course still useful. He even goes so far as to say that nothing which imitates particular phenomena is beautiful."

I suggest that, as Plato grew older, his appreciation of art—by which he especially means poetry and music—declined. This does not mean that his aesthetic sense became dulled but that it developed in another direction. Being himself an artist, he felt pleasure in the contemplation of life and nature. There are passages which show a keen ap-

[42] Sometimes indeed Plato comes near to doing this: see the picture of the perfect man, *Rep.*, 472d. See also *Rep.*, 400c-401a. Socrates admits that painting and sculpture can express character, in *Memor* III, 10, 1-8.

[43] For full references on Plato's attitude to the poets see C. L. Brownson, *Plato's Studies and Criticisms of the Poets* (1920).

[44] *Lysis*, 214a: "they are, as it were, our leaders in wisdom;" cf. Prot., 316d; *Rep.*, 366b. Paintings are spoken of as beautiful in *Hipp. Maj.*, 298a and *Rep.*, 401a; music in *Gorgias*, 474e., *Ion*, 534a and passim.

[45] *Ion*, 534b.

UMI

preciation of natural beauties, as his description of the resting place where the discussion takes place in the *Phaedrus*,[47] and we may perhaps add his admiration of the stars in the *Epinomis* and the *Timaeus*.[48] Indeed we find Socrates saying that when he sees painted animals, or animals perfectly still, he wants to see them moving and living.[49] But as Plato grew in years he became more and more familiar with abstract ideas, and came to live even more intensely upon the intellectual plane. Nothing could then give him more pleasure than the discovery of a new idea, a further glimpse into the relations of the forces that are at work behind and beyond the world of becoming. The pleasure which the contemplation of works of art could give him was as nothing to the pleasures of study and research.

Charles Darwin complained that, as he grew old, he lost his aesthetic sense. Of this H. J. Marshall gives the following explanation:[50] "In reality he had lost the sense of beauty in the contemplation of works of art which were beautiful for him in his younger days, and to which the word beautiful had become so thoroughly attached in his mind that he could not dissociate it from the object. On the other hand he, as the result of his special mental occupations, had gained new and unusual mental fields; and, I have no doubt, found as distinctive an aesthetic thrill elsewhere, in his observation of developing forms of life, for instance, as he had even found in the artistic works of great masters." May not some such a change have taken place in Plato's mind? The habit of abstract meditation had given him the power to find more delight in his own thoughts than anywhere else. Conceiving these thoughts to have

[46] *Timaeus*, 28b.

[47] *Phaedrus*, 230 b-c, and the interest shown in the grasshoppers, 259a-d. Also 276b.

[48] *Epinomis*, 977b.; cf. *Timaeus*, 38a.

[49] *Timaeus*, 19b.

[50] *The Beautiful*, p. 81.

objective existence he attributed beauty to them and concluded that a similar training would bring this intense and—to him at any rate—aesthetic pleasure to others. That is his meaning where he tells us that the aim of education is the appreciation of beauty.[51] He never denied the beauty of art. But he asserted that it was less than that of the phenomenal world, and far inferior to that of the world of the intellect.

It is easy to dismiss this "beauty of the supra-sensous world" as "a metaphor" and a "confusion". It is more difficult to prove that the pleasure felt by the enthusiastic student, when, after many weary hours of search, suddenly the light appears and everything falls into its place, is essentially different from the pleasures given by a revelation of physical beauty.[52]

Physical beauty then only existed to the mature Plato, because it "reminded" him of the ideas that had given him so much delight and of which the phenomena were illustrations.

It now becomes clear why it was not unnatural for him to classify the products of the fine arts so low in the realm of beauty, inferior as a source of aesthetic satisfaction to life itself, and to the pleasures of study. Granted this attitude of mind, the decline of contemporary poetry may have helped to justify it. The metaphysical theory of the *Republic* (which may itself have been largely due to Plato's aesthetic experience) was ready to hand; add to this that his moral enthusiasm was shocked by the outrageous stories the poets told about the gods. But all these were but secondary causes which made excellent arguments against the fine arts but could not condemn them unaided, and which Plato could have overcome without difficulty, had he drawn his greatest aesthetic delight from the inspira-

[51] *Rep.*, 401a, ff.

[52] See Santayana, *The Sense of Beauty*, pp. 94, 199, 209.

tion they gave him.

But aestheticians cannot forgive Plato for not attempting to end the "ancient quarrel"[53] between poetry and philosophy, he who was both a poet and a philosopher. Bosanquet[54] considered an account of Plato's views on art to be a sufficient account of Plato's aesthetic and others have been so far misled as to maintain that he was one of those who "have thought and spoken of the aesthetic demands of man as of insignificant importance."[55] Enough has been said to show that this view is clearly mistaken.

G. M. A. GRUBE.
UNIVERSITY COLLEGE OF SWANSEA, WALES.

[53] *Rep.*, 607b.
[54] In his *History of Aesthetic*.
[55] H. J. Marshall, *The Beautiful*, p. 201.

A SPIRITUAL BEHAVIORISM

THE VIEW is generally held that the doctrine formerly known as materialism (but which I shall designate as physical monism), and the belief in an idealistic or teleological conception of the universe are incompatible theories of the world. Idealists and mechanists seem to be agreed that anyone who holds to both conceptions must be something of a multiple personality. Behaviorists are laboring under the delusion that all one has to do when he wishes to develop a "scientific psychology" is to accept the postulates and categories of physical science (and especially the doctrine of the conservation of motion), and he is thereby committed to relegating purpose to the limbo of animistic survivals. But if we widen our conception of physical processes to include purpose—and C. G. Darwin and others have pointed out that in atomic behavior the electron seems to display memory and a knowledge of the future—then we can accept teleology without fear of thereby introducing supernaturalism into science.[1] In the present

[1]By "purposive" behavior I mean that type of process which within certain limits is controlled by the past and is anticipatory of the future. In the atom the "memory" of the electron is related to the vector known as "angular momentum." In biological phenomena it is generally admitted that the past (or its results preserved as "memory") is active in present behavior. But the idea that the "future" also helps to determine the present seems preposterous to many. Dr. Alfred J. Lotka, with whom I have discussed this question of what I have termed "control of the present by the future," does not admit the necessity of the notion of purpose in explaining evolutionary advance. But I hold that the notion of the *instantaneous present*, like the *limit* of a *differential*, contains a vicious abstraction. Dr. Lotka has also discussed this subject in his *Elements of Physical Biology*. Hermann Weyl has touched upon the matter in his *Was ist Materie?* I have discussed these problems in detail in an article "The Problems of Time in Science and Philosophy," which appears in *The Philosophical Review*, 1926, Vol. 35.

essay I hope to show that a "spiritual behaviorism" can be derived from the most fundamental principle of physics, the principle of least action.

I shall first summarize the historical development of the concept energy; and then, after exhibiting its status in modern physical doctrine, I shall set forth what seem to me to be its philosophical implications.

THE EVOLUTION OF THE CONCEPT OF ENERGY

It has become fashionable to attribute to Aristotle the formulation of the view that qualities inhere in a thing-like core, as pins stick in a pin cushion. New Realists argue that this substance-quality view is the consequence of the Aristotelian logic of *classes*. But it must not be forgotten that for Aristotle the conception of *energeia* as the cause of motion takes precedence over the notion of substance, which latter seems to be nothing more than the permanent possibility of action. In other respects the consequences of the Aristotelian metaphysics have been less fortunate. His law of falling bodies, making velocity dependent upon mass, was false and had to be corrected by Galileo. And the influence of Aristotle in shaping the Scholastic doctrine of the thing and its qualities is also well known.

Physicists do not generally recognize the extent to which the present formulation of physical creeds is determined by the historical evolution of physical philosophy. It is especially true that modern scientists do not sufficiently appreciate the importance of the interaction between the views of Descartes, Leibniz and Newton, with the subsequent triumph of Newtonian physics.

Descartes, as is known, attempted to lay the foundations for a completely mechanical view of physical nature. In doing this he developed the Cartesian coördinate system, thus laying the basis for analytical geometry and Newtonian mechanics. In his law of motion of bodies, as

given in the statement that the product of mass by velocity is constant, Descartes presented a noteworthy formulation of the conservation of the quantity of movement. The interesting thing for us is the way in which the mechanical conceptions of Descartes reappear in Newtonian physics. Following the Cartesian view of the quantity of motion, or "momentum," as fundamental, Newton arrives at *force* as a "primary magnitude." In the dynamical theory of Newtonian physics the concepts of *force, mass* and *momentum* are the basic categories.

Had Newton been able to foresee the inevitable logical consequences of his doctrine in the godless universe of Laplace he might have been constrained towards a more hospitable regard for the views of Leibniz. The Leibnizian effort at a reconciliation of the mechanical universe of Descartes with a teleological view of nature rests on the reinterpretation of the notion of substance (or Cartesian *extension*) in dynamic terms. If Newton had followed Leibniz, as Huygens did, *work, mass* and *energy* (Leibniz's *vis viva* is "kinetic energy") would have been the primary categories.[2] But even though, as Bertrand Russell points out in his *Critical Exposition of the Philosophy of Leibniz,* several types of dynamical theory are confused, Leibniz's formulation of the law of motion as proportional to the square of the velocity has adapted itself more readily to the purposes of physics than the law of Descartes.

Maupertius (1698-1759), who was early given over to speculations as to what grounds the Creator had for preferring the law of inverse squares to all other possible laws of attraction, is generally credited[3] with having first enunciated the law of least action. He utilizes Leibniz's idea of making nature invariably work with a minimum of action. He states that light neither takes the shortest

[2] *A History of Physics*, by F. J. Cajori, 1899, pp. 52-53.

[3] *The Principle of Least Action*, by P. E. B. Jourdain, Chicago, 1913.

path nor the path which it describes in the shortest time, but *"that for which the quantity of action is least."* The quantity of action is taken to be the product of the mass of the bodies times their velocity through the space they may traverse.

It is interesting to contrast the idea of Maupertius that following the line of least resistence testifies to the expression of the wisdom of the Creator with the modern idea that the doctrine of the conservation of motion dispenses with the necessity of a Creator.

While Maupertius in 1747 attempted to formulate a single principle of "least action," the first important quantitative advance had already been made by d'Alembert in 1743. These attempts stimulated Euler to thinking about the problem, and his ideas were eventually summed up in the simple principle that when v is a function only of the coördinates of the particle, the expression $\int v ds$ will be a minimum for the actual path of the particle, where ds is an element of the path, and v is the corresponding velocity. Euler assumed that the existence of maximum or minimum conditions in natural phenomena could be determined. Lagrange continued the work of Euler and d'Alembert and obtained a more comprehensive set of differential equations.

Another line of investigation results in a somewhat different way of expressing this same principle of the conservation of motion. Already in 1738 Daniel Bernoulli had turned to the impact of moving particles for the explanation of the pressure of gases. This kinetic theory was extended by later physicists. The doctrine of kinetic energy, an outgrowth of the theory of "central forces," is the prelude to the principle of the conservation of energy. Newton suspected the presence of the principle of the conservation of energy in mechanics, and Rumford had maintained the universality of the laws of energy. But Joule

and Mayer established the particular principle of the exact equivalent of the amount of heat produced and the amount of mechanical energy destroyed. The principle of the conservation of energy finds its verification in the discovery of the mechanical equivalent of heat.[4]

Eventually this doctrine that nature is stingy in her activities achieves the form in which W. M. Hamilton leaves it at the beginning of the nineteenth century. By assuming that the energy of a dynamical system consists of two proportions, the kinetic energy T and the potential energy W, Hamilton arrives at the formula of the conservation of energy as expressed by the equations $T+W=$ constant. In this form the principle of least action asserts that when a system passes from its state at one instant of time t_1 to the state at a second instant of time t_2, the sequence through which the system passes is such that the mean average value of the difference between the potential and kinetic energies during the interval of time of change will be a minimum. Mathematically this principle is stated in this form

$$\delta \int_{t_1}^{t_2} (T-W)\,dt=0$$

Thus through the co-operative efforts of Leibniz, Euler, Lagrange, Hamilton, and later Gauss, and others, the

[4]The principle of the conservation of energy and the principle of least action are not identical, although the former can be derived from the latter. The principle of least action is the more general principle. The relation between the two is brought out clearly by Max Planck in his *A Survey of Physics*, p. 110. "As an illustrative example, let us consider the motion of a free particle under no forces. According to the principle of the conservation of energy, such a particle moves with constant velocity, but nothing is said concerning the direction of the velocity, since kinetic energy does not depend on direction. The path of the particle could, for example, be rectilinear or curvilinear. On the other hand, the principle of least action demands, as we shall show in detail below, that the particle must move in a straight line."

"The reason for the difference in the results derived from the two principles lies in the fact that when applied to any problem, the principle of the conservation of energy furnishes one equation only, while it is necessary to obtain as many equations as there are variables in order to determine the motion completely. . . . . Now the principle of least action furnishes, in every case, as many equations as there are variables."

doctrine of the conservation of movement, the "mother of analytical mechanics" becomes a general principle of dynamics. The philosophical importance of this conception cannot be stressed too much. This law of thrift is the forerunner of the principle of economy of which Ernest Mach makes so much use. And the bearing of the principle of the conservation of energy upon the mind-body problem, the *law of parsimony,* and the principle of the *uniformity of nature* is well known.

MATTER AND ENERGY

Two conceptions stand out in classical mechanics. These are the doctrine of the conservation of matter and the doctrine of the conservation of energy. W. Ostwald, it will be remembered, attempted to set aside this dualism of matter and energy in his *Naturphilosophie* of energetics. But Oswald's system fell to the ground when electrons were discovered, for his view excluded a corpuscular metaphysics. Nevertheless, the physicist seems to be reconstructing his picture of the universe somewhat along the lines pictured in Ostwald's energetics.

One of the most interesting developments in modern physics is the overthrow of the doctrine of the conservation of matter. Theoretical physics now tells us that energy is the sole reality in nature. The experimental justification for casting overboard the formerly sacred idea of the conservation of mass was found when it was shown that mass is a function of velocity, and is not invariant under all conditions. In the theory of relativity mass appears as a special kind of energy. Matter can be transformed into energy, and energy can manifest itself as mass.

This means, therefore, that energy exists in two conditions: It may be "bound" as in matter, or aggregates of electrons, or it may be "free" as in radiant energy, e. g., *light.* Does this imply that light may be converted into

electrons, and *vice versa?* After discussing the question of reciprocal conversion of matter and energy Sir Oliver Lodge[5] raises the further question: if the stopping of the motion of an electron generates a wave of light, does this mean that when a wave of light is stopped it generates an electron? Is it possible, Sir Oliver asks, that radiation is a half-way stage between aether and matter? Matter, we knew, tends to fall together gravitationally; radiation tends to spread towards the outermost boundaries of the universe. Can we suppose that this energy is not completely lost by dissipation, but that there is a reintegration of energy by a process in which matter is actually generated? One would hesitate to indulge in such speculations if he did not have the sanction of seriously minded physicists. Dr. J. H. Jeans supposes that such a transformation of matter and radiant energy accounts for the intense radiation from the stars. Joseph Larmor has also recently expressed doubts concerning the permanence of substance, and this only reinforces the suggestion of Lodge that energy may pass from matter to aether and back again.

Other consequences equally surprising flow from this marvelous picture of the universe which physics and astronomy reveal. If a body absorbs a quantity of energy E, the body behaves as though its mass were increased by a quantity of energy E/C^2, where C is the velocity of light (though it must be remembered that the measurement must be made from a system at rest with reference to the body observed). If a body delivers up energy its mass is decreased by E/C^2. The relation between inertial mass and energy is given by the equation $m=E/C^2$. *All* mass is energy and the energy stored up in any body is mC^2. This value is very great because C, the internal of intra-atomic energy, is so large; so that for all practical purposes, alterations of energy through radiation or absorption are neg-

[5] "The Aether and Electrons", *Nature*, Vol. 112. pp. 85ff.

ligible so far as mass is concerned.

The "energy density" at any point per unit time equals the energy flux entering or leaving the unit volume. An electron in motion is to be considered as a sharply delimited sphere of space wherein the electromagnetic energy of the *field* is concentrated. According to Newton the sphere of action of matter varies inversely as the square of distance Newton's law must now be regarded as expressing the attraction of energy by energy, and allowance must be made for the variations of mass which accompany the variations of velocity of bodies measured with respect to the absolute velocity of light.

WHAT IS ENERGY?

In a spiritual behaviorism the fundamental reality of the universe is energy. Here we are following in the steps of Huxley when he asserted that nothing endures in the universe save the ordered flow of energy. But there are others who are inclined to criticize this reification of the concept of energy into a reality-in-itself. Preceding the advent of ultra-modern physics there were two answers to the question, is energy real? In the one view, energy is a reality having the same degree of validity as matter. In the second view, energy is considered to be an abstraction, or a mathematical function. In his *The Philosophy of 'As If'*, H. Vaihinger classifies energy as a "personificatory fiction" (Eng. trans., p. 36). Similarly, in criticising Herbert Spencer's notion of the persistence of force Bertrand Russell points out (*Mysticism and Logic*, p. 104) the error of identifying a mathematical constant with a particular entity.

Professor W. P. Montague has argued that consciousness is nothing more than potential energy associated with the cortical synapses. Unfortunately the notion of "potentiality" is very difficult to think through. In physics po-

tential energy is introduced to balance the accounts. As H. Hertz[6] points out, potential energy does not lend itself at all well to any definition which ascribes to it the properties of a substance. The amount of substance is necessarily a positive quantity; but we do not hesitate in assuming the potential energy in a system to be negative. But in reply to such objections it might be said that energy does not need to be made into a substance to be real. This notion has always been the fallacy of materialism. To attribute to potential energy a negative value does not mean that it is less than nothing, but that it is mathematically convenient so to treat it. In his very excellent work on *The Mystery of Mind* (1926, Ch. XV) L. T. Troland argues for a view which resembles Dr. Montague's. Potential energy is represented by the stretched condition of the "lines of force" which make up the electrical fields. He further argues that pleasantness is correlated with the decrease of synaptical resistence in which potential energy is converted into kinetic.

If anything in the universe is real it is energy. I shall continue to assume that energy is something more than a mathematical constant. This is not saying that we know what energy *is*. If we can not agree that a thing *is* what it *does* then we must concur with Wm. McDougall when he says that *what* energy is no man can tell, beyond saying —it is the possibility of change, of further evolution. But this evolution, it must be added, is always the evolution of different complexes of energy.

CONSERVATION IN RELATIVITY THEORY

Since mass and energy are regarded as synonymous, the conservation of mass and energy are two expressions of a general principle which can be termed the conservation of the "world impulse". Mass, in the older sense, is not

[6] *The Principles of Mechanics*, London, 1899, p. 22.

conserved, but it is the total quantity of mass and energy which remains constant. There has been some discussion as to whether the *geodesics* which bodies follow define a minimal principle of action or a maximal principle. In ordinary mechanics we like to picture the motion of bodies as a linear relation between the coördinates of space and time. This is a straight line in the geometry of Cartesian coördinates. The exact form which this demand that bodies move in minimal lines should take in the theory of relativity is a matter of dispute. The problem is to translate the restriction that $\int ds$ be a minimum (i. e., $\delta \int ds = o$) into terms of geodesics in the non-linear equations of the general theory of relativity.

Under certain conditions the idea of straightest and shortest coincide. This is true in the theory of curved surfaces. In conformity with the "impulse energy tensor" of the theory of relativity a particle takes the line of least resistance in the sense that the trajectory it traces out in its motion expresses the geodesic line for that manifold. If the time path of a particle be considered as a fourth coördinate of the space-time continuum, this *world-line* will, in its most general form, be represented by the arc of a great circle traced through the curvilinear universe. *Action* (i. e., energy integrated through time) is conserved, because action is related to the curvature of the world. Here the princple of least action becomes transformed into the conservation of the *world-impulse*. Action is conserved because energy can not wander off to infinity. We are living in a spatially closed universe.

Does this mean that nature as a whole takes the line of least resistance? I do not see that it does. For any point in the path of progress (i. e., a tangent to the cosmic curve of action) motion is conserved, but in the long run nature rises above mechanism because *time* is not a closed dimension (does not return upon itself), as are the space dimen-

sions, but time is open towards plus and minus infinity. The cosmic curve of action (the macroscopic time-line) may be curvilinear, but it ought not be a circle: an ellipse or a spiral would be nicer. If time returned upon itself nothing new could really happen, and we should be forced to accept Nietzsche's doctrine of eternal recurrence. But perhaps what we humans think to be "nice" may have nothing to do with the matter.

THE CONTINUANT

Philosophically the most important fact which emerges from the researches in theoretical physics is that matter is not so substantial as it used to be thought. Apparently the only psychologist who is alert to the significance of this is C. S. Meyers,[7] who points out that the effect of this is to make it less difficult to understand the interaction of psychic and neural energy.

The average person is unaware of the extreme difficulty of defining what constitutes a "thing." Philosophers outgrow the naive viewpoint of the "common man" when they recognize that the thing is, to a certain extent, a "teleological construct." The problem becomes still more complex when we make the further discovery that the constancy or permanence of a thing is relative, not only to our human purposes, but also to the physical frame of reference from which it is observed. So far as these problems are concerned the most fertile suggestion which the present writer has met with is presented by Dr. A. N. Whitehead[8] when he suggests that "amid the alternative time systems which nature offers there will be one with a duration *giving the best average cogredience* with the subordinate parts of the percipient event" (italics are present author's). I

[7] "On Consciousness," *Proceedings of the Royal Society of Medicine*, 1925, Vol. XVIII, pp. 9-13.

[8] *The Concept of Nature*, p. 111.

UMI

am surprised that Dr. Whitehead's speculation (p. 69) that the alliance of the passage of nature with the passage of mind, given in sense awareness, arises from their sharing in some ultimate passage which dominates all being has not been made more of by the idealists.

But giving full weight to the facts which indicate the extent to which the observer's "apperceptive synthesis" enters into the "thinghood" of the object perceived, it seems to me that every *type of object* must possess thinghood of its own right. Each type of object in nature must have an inherent unitary mode of behavior peculiar to itself. Furthermore, the "material" elements of which the thing is composed (molecules, atoms, electrons, etc.) are themselves unitary modes of behavior which remain invariant for the particular complex into which they enter. A *thing,* therefore, is a synthesis of micro-events. The permanence of substance arises from the fact that a group of random movements is organized into a new unitary "stuff" because the thing retains an integral value with respect to the frame of reference from which it is viewed. Every unitary group of movements expresses "central tendency" of a statistical configuration of elements, which, in their range of action, vary within narrow limits about a mean position. *Any thing is a kind of statistical constant of high stability.* This doctrine is now of special importance in chemistry, where certain elements formerly supposed to be simple (e. g., mercury) are now known to have several forms, and the element is really an average of several *isotopes.*

Adopting a type of classification popularized by C. D. Broad, we might speak of electrons as *first order objects,* atoms as *second order objects,* molecules as *third order objects,* and so on. I shall take over a term used by W. E. Johnson in his *Logic* (vol. III) and refer to these objects as *continuants.* Thus, in molecular phenomena, the atom is a continuant. But in radioactive transformations even

the atom may cease to be a continuant, though the electron remains a continuant here. Since the term continuant designates the invariance of behavior which constitutes the permanence of the object, we may extend the range of its use beyond the field of the inorganic and refer to *life as a continuant,* in the sense that certain principles of behavior remain invariant for the specific aggregates of colloids which constitute the protoplasms.[9] *Mind* is also a continuant in the sense that it is a relatively stable dynamic synthesis of the units of the "psycho-physical continuum." The *self,* in this view, is a statistical constant (functional unity) of psychic isotopes. The tendency to preserve the stability of the self (to return to a physiological equilibrium E. Rignano would say) underlies the purposiveness of human conduct. For this reason the higher levels of synthesis in the nervous system assume domination over the separate reflexes of the lower levels. But where the integrative action is insufficient the central unity breaks down into the separate selves or psychic isotopes, and multiple personality results.

PROBABILITY, NATURAL LAW AND PURPOSE

There has been much dispute as to whether any conclusion can be drawn with regard to the reality of purpose from the fact of the adaptation of organism to environment. I shall not attempt to argue the question in this form. But I hope to show that considerations of probability provide a better basis for the doctrine of teleology in nature. In the first place I shall attempt to show how it might be argued that the existence of an uncontrolled universe throughout all eternity is at least infinitely improbable, and then I shall state the answer which might be made by those who conclude that nothing can be proved

[9] W. J. V. Osterhaut in his *The Nature of Life* abandons growth, reproduction, motion and irritability as the invariable differentia of life and selects destructive metabolism and selective permeability as the invariants of living matter.

by arguments based upon probabilities. Then we must make our choice between the two positions.

The argument against mechanism has been well stated by Bergson, when he attempts to show that a series of variations in all directions, occurring in an accidental order, could not have produced an organ such as the eye. Orthogeneticists have also stated that many variations are not "useful" until several along a certain line of differentiation have assisted each other, so to speak. It is necessary to suppose, Bergson argues, that a purposive agency must have produced homologous structures along divergent lines of evolution. After the publication of Darwin's "Origin of Species" Mr. J. J. Murphy[10] argued that no theory of selection yet propounded could explain the development of the eye: "It is probably no exaggeration to suppose that in order to improve such an organ as the eye at all, it must be improved in ten different ways at once, and the improbability of any complex organ being produced and brought to perfection in any such way is an improbability of the same kind and degree as that of producing a poem or a mathematical demonstration by throwing letters at random on a table."

Now a popular argument presented by biologists to explain the emergence of a particular result in evolution (such as the extremely complex configuration of inorganic elements necessary to any specific protoplasmic system) runs somewhat like this: Admitting that any combination of factors is statistically of a very low degree of probability, nevertheless, if you give nature an indefinitely long time in which to work, every possible kind of combination will at some time or other be produced. And among these combinations will be what we call living matter. But the advocate of a purposive agency might meet this

[10]The following passage is quoted from Sir Arthur Keith's Huxley Lecture on "The Adaptational Machinery Concerned in the Evolution of Man's body," *Nature*, 1923, Vol. 112, pp. 257 ff.

reply with the following: Previously we have supposed that the successfulness of any mutation depends on the convergence or intersection of several lines of differentiation. Let us assume further that the production of a given variation in any one line of differentiation is governed by a series of factors ("causes") which itself is infinitely complex. Does it not follow that the likelihood that these mutually necessary variations will occur simultaneously is not only infinitely improbable, but that the improbability is of a higher order of infinity? That is, to view the thing mathematically, the likelihood of any one point of a line (an infinite series) meeting any other specified point of another line in the same plane would be of the order of improbability infinitely squared, ∞^2. The reply to this might be that there is as much time as there are probabilities. But is there any sense to supposing that nature has infinity to the infinity power to work in? This, I presume, might be a fair statement of the modern version of the "watchmaker theory" of the universe. What reply might be made to such a course of reasoning?

There is no mystery about the facts of adaptation and the evolution of what seem to be purposive structures.[11] Only those structures that persist (survive) because they are "adapted" come under our observation. Those that are not "adapted" for the most part escape our observation. Thus we gain the impression that the structures that have persisted *were brought into being* by their adaptedness, whereas the fact is that they were merely *brought into our observation* by that "adaptedness" Both the adapted and the not-adapted were brought into existence by circumstances impartial to their "adaptedness." Those persons who keep reminding us (quite

[11] I have discussed this matter with Doctor Alfred J. Lotka. His reply to the foregoing arguments is the best statement I have come across and what follows in the next two paragraphs is largely in his own words. Dr. Lotka has discussed the matter in his *Elements of Physical Biology*.

unnecessarily) that natural selection can at best be an eliminating, not a producing, process overlook the fact that no one has ever claimed that selection is anything more than this; but this eliminating action seems competent, at least qualitatively, to account for the fact that the *observed* forms (i. e., the comparatively lasting forms) are of the adapted type. If nothing but adapted forms ever came into being we might be tempted to look for a productive agency in adaptation. But the fact is that unadapted forms are produced by the same physiological processes that also produced the adapted forms. That they (the unadapted) are not *more* common is due to the fact that our observation is made on the relatively adapted stock, for the non-adapted stock must, from the very nature of things, be in the minority.

Another fact to be carefully borne in mind in questions of this sort is that we are here dealing with the probability of a combination of events which undoubtedly are not independent. This, of course, very materially influences the numerical value of such probability, in accordance with a fundamental principle in the calculus of variations.

The effect of the above statement is not to undermine the doctrine of purpose, but only to render ineffective the value of the arguments for teleology in so far as they rest upon the specified considerations of probability. The precise rôle and point of attack of purposive agencies in the affairs in a material universe is undoubtedly a good deal of a mystery today. If the proof for purpose ever comes it will not be based upon probabilities, Doctor Lotka informs me, but on a knowledge of the nexus of material happenings and psychic agencies. Personally I do not see how probability, if it be real, can be divorced from the progress of nature. I come back to the fact that a mechanical universe is one in which time does not count. But since man, who is a product of evolutionary forces, has developed an intui-

tive consciousness of time which is of an irreversible order (non-mechanical), there must be in nature an energy operating which makes what does happen in the universe something more than merely the spatial redistribution of mass particles. And I believe that Bergson is right in pointing out that this moving energy (*l'élan vital*) is more akin to the *experienced* time of duration than the *measured* (spatialized) time of physics. However, it seems to me that this principle operates not only in the field of the organic, but also in the realms of the inorganic, the domains of the physical sciences.

A gap similar to the one which separates physics and biochemistry appears in the jump from electrons to atoms, atoms to molecules, and molecules to crystals. Within any level of nature the law of behavior of the elements may be mechanical. Here the effects are averaging effects, and whatever unity there is is that of a statistical constant. *But when you pass from one type of object to another probability becomes discontinuous.*

Back in 1874 Helmholz[12] suggested the possibility of two kinds of laws: the first type of law is associated with *forces of the first class,* such as gravity, the intensity of which is independent of time and velocity and dependent upon distance; and *forces of the second class,* such as electrodynamic forces, which become active only under certain conditions of motion (i. e., induced currents, electromagnetic phenomena). I doubt whether this particular distinction is now tenable, but it does seem to be true that there are two types of laws in the universe, and that the distinction between mechanical and purposive forces is somehow related to statistical and non-statistical laws.[13]

[12]"On Later Views of the Connection of Electricity and Magnetism," *Smithsonian Institute Reports,* 1874, pp. 246-253.

[13]Under the head of "Statistical Law and Ontological Proof" Professors W. H. Sheldon and H. R. Smart carried on a discussion in the *Philosophical Review* (1924) which bears upon the problem of the duality of natural law. Unfortunately they could come to no definite conclusions.

UMI

Thus the second law of thermodynamics simply does not apply to the transition states, from one type of object to the next, because it expresses a disorderly tendency of things to become mixed up, whereas when we pass from atoms to molecules a new type of law or orderliness appears, and this orderliness is discontinuous with the probability of the previous system.

INTEGRATION AND EVOLUTION

It was previously pointed out that there is a very intimate relation between matter and the field of energy in which it is imbedded. The so-called empty space which surrounds material particles is filled with the radiant energy which makes chemical action possible.[14] One kind of frequency is active in the behavior of atoms. Professor Millikan's discovery of "penetrating rays of cosmic origin" is opening the eyes of our imaginations in this direction. Another type of frequency (e. g., infra-red rays) may be active in chemical (thermodynamic) and molecular behavior. And we are just beginning to understand the influence of radiant energy on living matter.

This brings us to the most difficult problem of why those aggregates of bound energy which we call things emerge. Higher types of objects (continuants), we have seen, emerge in nature because the course of evolution is not controlled entirely by the differential equations of dynamics. Natural processes seem to be a compromise between the principle of least action and the principle of maximum energy expenditure. This time-spanning energy is the moving power behind biological evolution. But first let us approach the problem on the inorganic level.

Newton showed that the force of attraction F, between two material particles of masses m_1 and m_2, separated by

[14] In his book on *Atoms* (1916) Jean Perrin takes the position (p. 163) that "*the essential mechanism of all chemical reactions is therefore to be sought in the action of light upon atom.*"

the distance d, is expressed by the equation $F=G.\ \frac{m_1 m_2}{d^2}$. This law, as we have seen, must now be construed as expressing the attraction of energy by energy. In this form the law is stated independently of the qualitative nature of the bodies attracted. Electrical charges are conceived to be balanced. The same geometrical relation underlies the force of attraction (or repulsion) between two charged spheres and is given in Coulomb's law $F=\pm K\frac{m_1 m_2}{d^2}$. Here again the force acting varies inversely at the square of distance. That is, $F \propto \frac{1}{r^2}$ where r is the distance between the poles. This relation, it is known, also underlies the variation of intensity of light and sound with distance. That is, $\frac{I}{I_1}=\frac{r_1^2}{r^2}$.

In the law of attraction of bodies and the law of radiation of energy we have two laws of similar form governing opposite processes. On the one hand, radiation tends to spread outward in spherical waves towards the outermost boundaries of the world; on the other hand, matter tends to fall together in accordance with gravitational attraction. The energy of matter comes from an unknown source, and proceeds into space towards an equally unknown destiny. If the source and the sink could be identified we could understand where the energy of matter comes from and where it goes to, and why the universe has not long ago run down. This view was at first suggested, I believe, by Professor W. D. MacMillan, and has been restated in different forms by Sir Oliver Lodge, J. H. Jeans, H. N. Russell, and others.

Is it a tenable hypothesis that "matter" is a compromise between two countertendencies; an inflection point where the cosmic curve of action changes direction? At one "pole" of nature the world is running down, and at

the other "pole" it is running up. But where are the poles? Certainly each atom has its poles, but whether there is polarity in the universe at large is a more difficult question. Professor K. Koffka has supposed that the whole universe is a *Gestalt*, but the universe as a configuration in which matter and energy undergo reciprocal conversion while yet retaining a macroscopic equipoise would seem to constitute an exception to the type of *Gestalt* which is illustrated by Dr. Charles M. Child's "metabolic gradients." Perhaps a final picture will portray the universe as a result of a compromise between two pervasive principles of nature: a principle of *least action*, which expresses the attempt to reduce the "surface tension" of our cosmic bubble, and a principle of *maximal action*, which designates the tendency to use up the available potential (or free) energy of configurations. A detailed application of these two principles to the various *emergents* in nature (or the cosmic *Gestalt*) will appear shortly.

OLIVER L. REISER.

UNIVERSITY OF PITTSBURGH.

CRITICISMS AND DISCUSSIONS

SCIENCE AND SUBJECTIVITY

The question whether or not science must ultimately recognize subjectivity as a determining factor in its methodic ideal has recently been revived owing to certain developments within science itself. To a considerable number of thinkers there seems no way of interpreting the theory of relativity with its orientation from the standpoint of the observer confined within a seemingly parochial system of reference, save by frankly acknowledging the subjectivity of science and its ultimate centering in the point of view of the individual. This state of opinion finds a vigorous exponent in the English philosopher, H. Wildon Carr, especially in his recent book *A Theory of Monads: Outlines of the Philosophy of the Principle of Relativity*, where this thesis, together with the metaphysical and psychological conclusions deduced from it, is one of the outstanding contentions.

Science, according to Professor Carr, is today undergoing a revolution of well-nigh unexampled proportions involving a complete revision of its fundamental principle. It no longer seeks any independent objective absolute as a basis or believes that it studies a world of pure external existence apart from mind, but discovers instead that "ultimately every observer is the unique center of his own system of reference" and that "there is no objective scale by reference to which magnitudes can be assigned an absolute value."[1] In consequence of this conversion to subjectivism, science is coming to discard the hypothesis of the atomic structure of the universe in favor of a monadic one, and to substitute for a mechanistic account of natural processes the freedom of individual activity.

For the benefit of those to whom this news of the volte face of the sciences may come with something like a shock, it may be well to sketch Professor Carr's reading of the evidence which he takes as pointing in this direction. Like all revolutions, this too has been long

[1]Carr, H. Wildon, *A Theory of Monads: Outlines of the Philosophy of the Principle of Relativity*, p. 79.

UMI

preparing, its causes deep laid in the nature of science. "Its fall of the Bastille," says Dr. Carr, "was the verification of Einstein's calculation of the shift of the stars, observed during the total eclipse of May 29, 1919."[2] And as chief causes of the cataclysm, he enumerates three: (1) the doctrine of Berkeley, (2) the scientific conception of life, and (3) the modern criticism of mathematics which has led up to and found its culmination in the theory of relativity.

As for Berkeley, there are few who would care to deny that his philosophy has served to call the attention of thinkers, scientific and otherwise, to the part played by the percipient in the structure of knowledge and to the problems involved in determining the status of sensations and conscious states in that structure. Attempts to pass these latter off as non-existent or as mere shadowy redundancies (epiphenomena) of physical events have proved in the long run hardly more satisfactory to physicists than to philosophers. And it must be admitted that Berkeley's position has lately been reinforced from within physics itself through Einstein's clear demonstration that "the activity of the observer is an essential determinant factor of the nature of the physical fact itself."[3] All this, however, seems perfectly possible of acceptance without our being obliged to draw the conclusion drawn by Carr that Berkeley and Einstein are therefore influences constraining science toward subjectivism. While Berkeley may be truly credited with having demonstrated the relativity and subjective dependence of the primary and secondary qualities, his demonstration has plainly to do with them as metaphysical entities and not as scientific facts. The questions at which he labored and the methods by which he answered them were first and last philosophical, and his influence on science was at best only indirect through calling attention to the problems involved in certain phenomena. What Berkeley, and more especially Einstein, have brought home to the scientific world, it would appear, is not subjectivity, but the conviction that, if science is to hope for accuracy, all the conditions of a given event must be taken into account, and that *what the object is experienced as* must be accounted one of the objective conditions. To Einstein in particular belongs the credit of having shown that what the world is perceived as from any and all possible physical points of view constitutes the essential part, if not all, of its objective nature for natural science.

Another factor which, according to Carr, has been instrumental

[2] *Ibid.*, p. 3.
[3] *Ibid.*, p. 5.

in making clear to science the subjectivity of its method is the scientific conception of life. This conception, as it stands today, is derived through the application to biology of the mechanistic principles of physics, and represents life as the resultant of an evolutionary process governed by natural selection and the laws of chance. Even the intellect has no free life of its own, but is held to be part and parcel of the evolutionary struggle. Yet this inclusion of the intellect in the process eventually entangles the mechanically-minded scientist in a fatal contradiction. For how can the intellect be the product of a theory which it has itself produced? "How can the intellect, a mode of apprehending reality, be itself an evolution of something which only exists as an abstraction of that mode of apprehending which is the intellect?"[4] The only answer to such a paradox, according to the author, is the admission that evolution thus mechanically conceived is a misleading fiction bred of the contrarieties of the intellect itself.[5] Whatever truth there is in the doctrine points rather to the reality of a free, psychical activity *élan vital* as the underlying source of all life and development. And here the name and teachings of M. Bergson in favor of a spontaneous, contingent evolutionary process are added to those of Berkeley and Einstein as a further influence pointing toward subjectivism.

But the charge that a contradiction is involved in the notion that the intellect can be both the source and product of evolution seems largely specious. At any rate, the contradiction, if there be one, appears not only in the mechanistic conception of life but in all theories which assume the genuineness of objective knowledge. For any view which would escape the circle of inner consciousness must assume the self-transcendent and self-representative power of thought to pass beyond the data of immediate experience and to adopt the rôle of spectator of its own development in the natural order. In all its relations intellect is obliged to assume its capacity as a theoretic *means* to reveal an *end* or object, of which it is itself a part, without necessarily distorting or falsifying the object. Indeed, there could hardly be a notion more baleful in its effects upon knowledge than that theory, broadly speaking, falsifies or itself creates 'facts' which it purports to disclose. Such a notion if once established would suffice to end the research.

[4] *Ibid.*, p. 6.

[5] *Ibid.*, p. 5. "If intellect is a product of evolution, the whole mechanistic concept of the nature and origin of life is absurd, and the principle which science has adopted must clearly be revised."

UMI

A third line of criticism which, in Professor Carr's opinion, has played the really decisive part in discrediting objective and absolute conceptions in science, is that addressed to the foundations of mathematics. Modern investigations of the mathematical continuum show it to be a concept constructed from the implications of sensible perceptions; while recent criticism of the postulates of geometry has reduced Euclidean geometry from its apparently severeign status as the only possible science of space to that of a mere limiting case among an endless number of systems of equal rank, and in some cases based on directly opposite postulates. Such researches, according to Professor Carr, disclose how even mathematics (generally accepted as the typical exact science) is determined by the point of view of the subject. But it is only in the general principle of relativity that this view attains full cumulative expression to the extent that it effects 'a complete revolution of our notions of the structure of the universe.' "The essence of the general principle of relativity," he avers, "is to introduce the bane of the physicist, subjectivism, into the arcana of physical science."[6] And elsewhere he describes the foundation of Einstein's and Minkowski's theory as "the conception of scientific reality as consisting wholly in individual experience," so that in consequence "the objectivity of science derives its whole meaning from the activity of the subject."[7] The repeated failure of experiments like those of Michelson and Morley to determine the movement of a system by observations within the system is interpreted to mean that scientific results are in all cases finally regulated and controlled by the observer or the subject of the experiment.

But it is impossible to let these statements pass without question. After all, is it true that the theory of relativity is influencing recent science to abandon its belief in an objective standard and to accept subjectivity as its basic principle? An attempt to answer this question requires some analysis of what Mr. Carr means by subjectivity and an effort to understand in what sense he finds these tendencies operative in relativistic physics. (1) First of all, there seems little doubt that he holds as subjective every emphasis by recent science on the uniqueness of the observer's standpoint, and the recognition that each percipient measures the world in terms of his particular system of coordinates. (2) Indeed, Dr. Carr goes further in urging that only from a unique individual standpoint can any system be viewed in its integrity, and hence that science must accept as ultimate

[6]Carr, H. Wildon, *The General Principle of Relativity*, p. 21.
[7]*A Theory of Monads*, pp. 10-11.

the determinations of the individual subject which each system applies to itself. (3) Again he indicates his belief that in the theory of relativity an element of free choice, subjectivity in the sense of psychical spontaneity, becomes explicit. (4) Lastly, he implies that to his mind relativity marks the recognition by physical science of a transcendent factor, of subjectivity as denoting the presence of pure egos or monads as the directive force of the phenomenal process, even while they themselves remain outside the range of observable phenomena.

However unversed in the mathematical intricacies of relativity the student of philosophy may be (as is the case with the present writer), he may yet have gained certain general impressions of the theory which, in connection with his impressions of science, may seem to justify divergence from Dr. Carr's interpretation and the philosophical conclusions which he derives from it. The root of the trouble rests in Dr. Carr's contention that the theory of relativity represents the universe as constituted of monads. When you look behind the brilliant mathematical devices of Minkowski and Einstein, he declares, what you find is a conception of reality in essentials precisely like that of Leibniz: a view of reality as constituted of unique subjects of experience, each mirroring the universe in its active center, in which mirroring, moreover, the world of nature entirely consists.[8] It is in the course of developing this parallel between Leibniz and Einstein that he is led to make what appear to be unfounded claims as to the subjectivism of the Einstein theory.

In calling attention to the uniqueness of the observer's standpoint, Mr. Carr has apparent justice on his side. The theory does indeed suggest that each observer makes his observations from his special space and time coordinates; and calls attention to the impossibility of knowing anything about the laws of nature independently of observer's and their systems of reference. On the other hand, its emphasis upon the observer's coordinates is not, it would seem, for the purpose of stressing the inner, elusive, unshareable character of the psychical, but rather to maintain the high tradition of scientific objectivity which requires that all the conditions of a given event be taken into account. Of these objective conditions, the measurement of the individual observer from the standpoint of his particular reference body must be accounted part: and should this fact be denied or overlooked, the results must inevitably involve just so much needless discrepancy and error. In calling attention to the effects of such oversight, the voice

[8] *Ibid.*, p. 10.

of Einstein is the voice of scientific objectivity. Here Whitehead has recently given the scientist's answer to the subjectivist interpretation: "The relativity of space and time," he says, "have been construed as.. dependent on the choice of the observer. But it is the observer's body that we want, and not his mind. . . The question is, why did (Michelson's) interferometer have black bands on its screen, and why did not these bands slightly shift as the instrument turned."[9]

Moreover, although taking account of the observer, the theory of relativity seems far from conceiving the individual subject as the determining principle of reality, or from conceding that the ultimate truths of nature are to be found in any particular system of reference viewed from its individual standpoint. On the contrary, since the space and the time values of any given system are only relative, the possibility is precluded of finding universally valid measurements within such a system. True and universal conclusions regarding natural processes can only be reached, as I understand it, where we can combine according to certain definite rules measurements made from other reference bodies. In spite of the relativity of the space-time measurements of each particular system, it is nevertheless possible to arrive at an objectively valid description of physical processes owing to the fact that all these particular measurements correspond according to definite rules, and can be correlated according to certain principles of transformation.[10] Thus, although the standpoint of the individual system is taken into account, it is, as it were, cancelled out through its combination with the measurements of other reference systems; so that the laws of nature are freed from dependence upon accidental features of individuality and hold not merely for one system but for all systems.

No less does relativity seem to discount the pretensions of subjectivity in the sense of free choice. For while it is true that we always start from some particular frame of reference which we appear to select more or less arbitrarily, nevertheless the laws of nature determining our results are themselves independent of the choice of our system and, as has been said, hold alike for all systems. Accordingly, choice (even though present) is of no ultimate effect in

[9]Whitehead, A. N., *Science and the Modern World*, pp. 167-8.

[10]Cassirer, E., *Substance and Function and Einstein's Theory of Relativity*, (tr. by W. C. and M .C. Swabey), p. 381 f. "The theory of relativity . . teaches first in the equations of the Lorentz transformation and then in the more far-reaching substitution formulae of the general theory, how we may go from these particularities to a definite whole, to a totality of invariant determinations." *Cf.* Meyerson, E., *La deduction relativiste*, p. 212.

the general theory in so far as it recognizes no 'privileged' reference bodies, but declares that "all bodies of reference K, K′, *etc.* are equivalent for the description of natural phenomena."[11] For the very reason that the theory aims at universality, subjective choice can exert no decisive influence upon it so long as it holds true to its principle of the equivalent of all reference systems of the laws of nature.

Lastly, nothing surely could be less acceptable to physicists than the notion that the theory of relativity introduces 'minds' or 'monads' into physical science. In professing to discover that free active selves, subjects that cannot be objects, are implied here, Mr. Carr seems to be trying to remove the basis of modern physics to a transcendent world. Indeed, were the universe really composed of minds or monads, any ultimate reason for the existence of physical science would be withdrawn. For monads are 'windowless'; to them 'there is no without'; hence science in such a universe would have no world on which to act. Nor is this all. The introduction of monadic conceptions into physics would violate one of the most fundamental postulates of natural knowledge, which Leibniz himself designated as the 'principle of observability.' This is the postulate which forbids physical science to introduce any supra-phenomenal or non-observable elements into its system, recognizing that such a violation of principle would be equivalent to its death warrant. Positively phrased, the principle declares that nothing fundamentally outside the sphere of observation can have being in the physical sense. Yet it is only too evident that the admission of pure subjects or monads as directive forces by physical science would constitute just that surrender to obscurantism against which Leibniz was moved to protest.

But there seems scarcely need for concern on this score; instead of monads, present science would seem to prefer hypothesis indicating an atomic structure of the universe. Not that modern science would accept atomism in any crude sense of reducing the world to a collection of simple, extended particles; but there is a widespread impression that by conceiving solids, liquids, gases, energy, electricity, as aggregates of units or charges, the laws of science can be made to apply to nature more simply and intelligibly than in any other way so far suggested. In line with this tendency there has developed the quantum theory of energy, the atomic theory of electricity, the dynamical theory of gases, in short, the whole kinetic theory of matter, together with a variety of hypotheses in chemistry and biol-

[11] Einstein, *Relativity: The Special and the General Theory*, tr. by Lawson, p. 61.

ogy, where atomistic conceptions may be traced through Mendelianism down to the latest speculations of heredity. In this connection, the opinion of Mr. J. M. Keynes expressed at the conclusion of his *Treatise on Probability* is worth quoting: that "the practical usefulness of those modes of inference on the validity of which . . modern science depends, can only exist—if the universe of phenomena does in fact present those peculiar characteristics of atomism . . which appear more and more clearly as the ultimate results to which material science is tending."[12] Indeed, if atomism be taken in its widest sense as signifying no more than the assumption that nature is reducible to units of magnitude, it seems not too much to say that such atomism is everywhere a postulate of scientific method in so far as science attempts to derive equations, calculations, probabilities,—in short, mathematical results—from the study of nature. Only by assuming something like the atomistic hypothesis, it would seem, can we associate physical states with reckonable numbers and treat them by definite quantitative methods.

In conclusion, the opinion may be reaffirmed that science is not, as Dr. Carr suggests, embracing subjectivism and monadic conceptions, but is on the contrary steadily advancing in the objectivity of its methods and ideal. The important axiom of method is constantly more clearly realized that experimental results are trustworthy in proportion as anthropomorphic elements, the 'personal equation,' and subjectivity (in so far as it defies objective control) can be eliminated. The physicist, the chemist, the zoologist, is, moreover, conscious of studying an object that is no mere extrapolation of his own point of view or projection of the relations in his sensations, but that has on the contrary its basis in universal, necessary conditions over which the private individual mind as such has no determining control.

MARIE COLLINS SWABEY.

NEW YORK UNIVERSITY

[12] Keynes, *A Treatise on Probability*, p. 427.

SCIENCE AND SUBJECTIVITY

By the courtesy of the Editor, I have been allowed to see Mrs. Swabey's interesting article and invited to reply briefly to her criticism of my interpretation of the principle of relativity as being in effect the abandonment of belief in an objective standard and the acceptance by science of subjectivity as its basic principle. I am very pleased to respond, more especially as I find nothing to object to in my critic's presentation of my view. I would like, however, to make my general position clear on the main point, and, that done, to take up the writer's challenge on two positions clearly and definitely indicated.

I am quite aware that to charge science with subjectivity is to most scientific workers engaged in physical research equivalent to charging science with being unscientific. Certainly to suggest that physicists in their minds are revolutionizing science by changing its principle from the study of nature in its objectivity to the study of mind in its subjectivity would be very like a suggestion of treachery. What I have described as the modern scientific revolution is something very different. It is a complete change in the meaning of objectivity which has introduced itself into science without any conscious purpose or directing influence on the part of those who are engaged in scientific experimental or theoretical work. This seems to me extraordinarily significant, and to understand its full significance we have to go back to the origin and development of the modern scientific conception of the physical universe. When we do so we see, not that the physicists and mathematicians today are reintroducing the obsolete concepts of the old metaphysicians, but that they are finding themselves confronted with precisely the same difficulties as those which Leibniz, for example, urged first against the mechanistic principles of Descartes and later against the abstract generalizations of Newton. In a curious way Newton's "Physics beware metaphysics" has turned against his own work, not in the sense that it reveals deficiency or incompleteness in the superstructure but that it concealed from him unsoundness in the foundations. The

UMI

general theory of relativity has revolutionized Newton's cosmology precisely in the points which Leibniz indicated as its metaphysical weakness. What has had to be abandoned in modern science is the ideal, so strenuously insisted on throughout the nineteenth century, of an abstract objectivity, the assumption of Nature open to the inspection of a contemplating mind and completely free from an entangling alliance with it. The new idea is not merely a recognition that objectivity has a relative and not an absolute meaning and that something of the subject characterizes all scientific knowledge; it is that the reality of the universe has to be conceived on an entirely new metaphysical principle and one which does not dichotomize into subjective and objective factors.

On two points Mrs. Swabey seems to challenge my interpretation of the principle of relativity: viz., my assertion that the principle has negatived the possibility of a standard of magnitudes, and my refusal to see in the laws of nature which hold good for observers in all systems of reference moving relatively to one another an objectivity which "cancels out" the subjectivity of their individual standpoints.

In regard to the first point, I will not ask that the standard of magnitudes if it exist shall be produced, for I suppose it will be generally admitted that it cannot even be indicated. What I imagine, however, is claimed by those who demur to my conclusion, is that the ratio between a small scale phenomenon and a large scale phenomenon, say between an atom and a solar system, is constant and absolute for all systems. This is no doubt true, but by no ingenuity, by no mathematical device that I can conceive possible, can this ratio provide a standard by which magnitudes are determined absolutely. Great and small keep a constant meaning for all observers, not because something they can refer to is absolutely great and something they can compare with it is absolutely small, but because in passing from one system of reference to another the observer finds that all magnitudes conform to the condition of his coordination, the condition that the system to which he is attached is at rest. If we accept the principle of relativity there is no way in which we can compare the magnitudes of different systems of reference with one another by passing from one to another and making observations from within. I do not think there is a real disagreement on this point among philosophers who accept the principle of relativity.

In regard to the second challenge, it is true that the laws of nature assume an invariable form for observers in all systems of reference,

whatever be the movement relatively to one another of the systems. In a way it may be correct to describe this as cancelling out the differences in the observations of individual observers from different standpoints. Cancelling out however does not imply that the differences are abolished. It is in this fact, namely that they are not abolished, that the necessity of metaphysical construction is manifest. The laws of nature are uniform for all observers in all systems of reference, not because there is real identity but because there is a possibility of ideal relations between the observers in the different systems. It is the ideal relation and not the real relation between two observers which enables each to observe for himself under his own conditions and compare with another observer observing for himself under his own conditions. The result of the comparison is as though the two had changed places while in reality each has remained in his own place. For my own part I can only say that I can rationalize the physical universe of relativity on a monadic principle and I cannot rationalize it on any other.

One last remark I would like to make in reference to the quotation from Mr. Whitehead's *Science and the Modern World*: "it is the observer's body we want, and not his mind." I know that many philosophers and in particular Mr. Whitehead, disagree with my interpretation of the principle of relativity, and generally the nature of their objections is clear to me. In regard, however, to the passage quoted I must confess to complete failure to understand what it means, and as Mrs. Swabey quotes it approvingly I wish she had gone on to interpret it. So far as I understand the principle of relativity, it is that, in passing from one system of reference to another, all the observations of phenomena adapt themselves to the condition of coördination that for the observer the system to which he is attached is at rest. How it can be consistent with this to suppose that the observer's body is in some way privileged and escapes this necessity I cannot understand.

H. WILDON CARR.

UNIVERSITY OF SOUTHERN CALIFORNIA

The publisher of the *Proceedings of the Sixth International Congress of Philosophy* is Longmans, Green & Co., 55 Fifth Avenue, New York City and 39 Paternoster Road, London. The price of the volume in paper covers is $5.00; in cloth binding, $6.00. Every active member will receive a copy without cost as soon as the book is off the press. Associate members are entitled to purchase one copy at the special price of $3.00. It is planned to publish the book in the late spring of 1927. Orders should be sent to the publisher, at New York or London, and not to the Editor of the *Proceedings*. It is requested that orders be sent in advance as far as possible to facilitate an accurate estimate of the edition needed.

EDWARD S. BRIGHTMAN, Editor.